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WELLESLEY COLLEGE AND THE DEVELOPMENT OF BOTANICAL EDUCATION IN AMERICA[1]

IT is an honor for one to be assigned any part, however minor, in the exercises for which we have assembled to-day, and I am not insensible to the high honor of being invited to give the address this evening. The most significant distinction between man and the rest of creation is his intellect, and the most important matter that can ever concern us is the advancement and diffusion of knowledge. We are met this afternoon to dedicate a beautiful building to these uses.

I have been fortunate in knowing something of this building from the time when it existed only as a need, then as a dream, then through all the various stages of plans in mind, blue prints, bids and contracts, disappointments and delays which mark the construction of every building worth having—and now the welcome stage of a dream come true.

I had almost said, "the final" stage of a dream come true; but that would have implied a misunderstanding of the entire situation, for the completion of this building bears somewhat the same relation to the department of botany of Wellesley as the graduation of students from college bears to their life work—it is only a commencement. True it is not, if I may use a pleonasm, an initial beginning, but it marks the beginning of bigger and better things, not only for botany in Wellesley, but for botany in America, for whatever facilitates better work in any discipline, anywhere, is a benefit to all.

What has gone into this building? Brick and mortar, of course, as those can testify who have watched it rise from day to day. But more than brick and mortar. Aspirations and ideals, hopes and wishes, ability in planning, impatience at delays, discouragements vanquished by zeal and persistence, a determination to have the best in order that the best may be accomplished; love, devotion and sacrifice—the building is fairly held together by these imponderables more firmly than by beams and concrete.

I would like to emphasize, if I may, the comparison of this occasion to a college commencement, for just as commencement day has been preceded by years of activity and accomplishment that justify the final diploma, so this building has been preceded by years

[1] Address delivered at the dedication of the new Botany Building, Wellesley College, November 4, 1927.

of splendid accomplishment (in the study and teaching of botany) that fully justify it. In his "Address on University Education," delivered at the opening of the Johns Hopkins University in 1876, Huxley spoke as follows:

I would say that whenever you do build, get an honest bricklayer, and make him build you just such rooms as you really want, leaving ample space for expansion. And a century hence, when the Baltimore and Ohio shares are at one thousand premium, and you have endowed all the professors you need and built all the laboratories that are wanted, and have the best museum and finest library that can be imagined; then, if you have a few hundred thousand dollars you don't know what to do with, send for an architect and tell him to put up a façade.

One could not truthfully say that all of the conditions laid down by Huxley as justifying a beautiful building have been here fulfilled, but enough of them have been met fully to justify this building.

It is true that Pasteur's early laboratory was an unhealthy cellar, that radium was discovered in an old shed, and that much of the world's scientific work has been poorly and inadequately housed, but there is no argument in all that. Men have attained the highest levels of religious experience in groves and tents, but I have never heard it argued that religion ever suffered by the building of beautiful temples, although such temples may at times have sheltered a worship wholly unworthy of shrine and worshipers.

If education and science are among the most important activities of the human race, they are worthy of being housed in as suitable and beautiful buildings as may be thought justified for business or religion. Beautiful architecture, like beauty in any form, is worth promoting for its own sake. Why should not beautiful buildings be planned for science and education?

I have referred to the gradual development here of the work for which this building is intended. Wellesley College was opened in 1875, at a period when botanical instruction in American liberal arts colleges was the exception rather than the rule, and when professors of botany were almost as scarce as blue roses. Asa Gray had studied and taught botany to the glory of Harvard College since 1842, but with the title "professor of natural history." He retired, two years before Wellesley College was opened, to devote himself to the herbarium and botanical research, leaving George Lincoln Goodale as professor of plant physiology and W. G. Farlow as assistant professor of botany.

At this time there were several men in medical schools teaching the specialized branch of botany known as materia medica, but so far as I can ascertain, there were (besides Farlow's at Harvard) only five chairs with the title "professor of botany," and only two more with the title "professor of botany and"—some other science, thus: Professors of botany: Edward Tuckerman, at Amherst, 1858; Daniel Cady Eaton, at Yale, 1864; William James Beal, at Michigan Agricultural College, 1870; Charles Edwin Bessey, at Iowa Agricultural College, 1870, and Sarah A. Oren, at Purdue University, 1875. Miss Oren was preceded in Purdue by John Hussy, who was professor of botany from 1875–1876. The other two were Albert Nelson Prentiss, professor of botany, arboriculture and horticulture at Cornell University, 1868, and Thomas Jonathan Burrill, professor of botany and horticulture at the University of Illinois, 1870.[2]

The botanists, Sereno Watson and Alphonso Wood, also flourished at about this time, but, so far as I can ascertain, not as professors of botany.

From the above information it will be seen that Wellesley was in the front rank of pioneers in America in the establishment of her chair of botany in 1878, and was probably the first woman's college in the world to have a separate chair. It is of special interest for us here that the establishment of a "school of botany" at Wellesley was a cherished hope of the founder, Mr. Durant.

It is perhaps not surprising to find this early attention to botany in a woman's college, for it is a venerable notion that botany is pre-eminently a study for women. Thus, as early as 1796, Jean Jacques Rousseau entitled his one botanical book, "Letters on the elements of botany addressed to a lady." In this book he stated his conviction that, "the study of nature abates the taste for frivolous amusements, prevents the tumult of the passions, and provides the mind with a nourishment which is salutary, by filling it with an object most worthy of its contemplations."

We should not fail to mention in this connection the splendid pioneer work in botanical teaching in the early years of the Troy Female Seminary (now known as the Emma Willard School). This school was founded in 1821, and as early as 1829 there was published (at Hartford, Connecticut) the first of several editions of "Familiar Lectures on Botany" for the use of higher schools and academies, by Mrs. Almira H. Lincoln, vice-principal of the seminary and teacher of botany there. The author states in her

[2] I am indebted to Dr. John Hendley Barnhart for the larger part of these data, but I have not made a sufficiently thorough search of the records to feel sure that I may not have omitted some professorship of botany established or filled in 1875. The years given above for each name are the years when the incumbents were appointed.

preface that the book was the outgrowth of some years of instruction of large classes in botany. We may infer, therefore, that botanical instruction was organized at the Troy Female Seminary at least prior to 1829, and over thirty years before the establishment (in 1858) of the first chair of botany in an American college.[3]

I believe that no botanist giving this address could resist the temptation to quote from Mrs. Lincoln's book:

> The study of botany seems peculiarly adapted to females; the objects of its investigation are beautiful and delicate; its pursuit leading to exercise in the open air is conducive to health and cheerfulness. Botany is not a sedentary study which can be acquired in the library; but the objects of the science are scattered over the surface of the earth, along the banks of winding brooks, on the borders of precipices, the sides of mountains, and the depths of the forest.

This would seem to imply that the early botanical work of the Troy Female Seminary was largely of the nature of what is now known as ecology, and one may picture classes of females, far huskier than we usually associate with that epoch, climbing steep banks and mountains, and pushing their way through the underbrush of dense forests in search of specimens and knowledge. The picture is not over-drawn, for in the catalogue of 1844–45 the "Report of the Committee of Examination" of the school, reads, in part, as follows:

> The class in botany we consider especially deserving of praise. We could not only judge of their proficiency by their familiarity with their text-book, but their knowledge was put to a practical test by the actual analysis of plants and flowers. This they did with a fluency and accuracy that gave most conclusive evidence of their own diligence and their teacher's faithfulness. Each young lady had an herbarium in which were pressed and tastefully arranged from 100–300 specimens, all labelled according to their classes, orders, genera and species. These have all been collected and arranged during the term, and mostly in the immediate vicinity of Troy, at no greater distance than would suffice for a morning walk or an afternoon ramble. In climbing hills and threading woods and valleys in search of flowers, the young ladies together with instruction have gathered strength, health and beauty.
>
> The study of botany seems to be peculiarly appropriate for women. Her skilful and tasteful hands find a pleasing task in the cultivation of flowers. Wherever we see the windows filled with the most beautiful flowers, native and exotic, the columbine trailing its vines over the portico, the garden walk fringed with violets, and shaded with roses, we there recognize the finger of woman, and look for the abode of neatness, order, cheerfulness and virtue. In all ages flowers have been made the objects of her care and the emblems of her purity and beauty.

Here we have an early expression in America, of the notion, once more prevalent than now, that botany is essentially a study for females. No misconception ever died harder; it is not dead yet, but like most erroneous ideas, it persists only among persons whose information does not entitle them to hold any opinion on the subject.

But from the above quotation, the fact emerges that instruction in botany was given by a woman in one of the first schools for women to be established in America.

As early as 1873 courses in botany (Gray's Botany) were given at Mount Holyoke Female Seminary by Miss Henrietta Edgecomb Hooker,[4] but Mount Holyoke was not chartered as a college until twenty years later. Without investigating the matter further, I hazard the guess that the courses given by Mrs. Lincoln at Troy were the first (or one of the first) courses in botany to be given by a woman in any country. In harmony with this fine tradition, Article VI of the By-Laws of Wellesley College states that the college shall provide instruction in botany. The first professor of botany, Susan Maria Hallowell, was at first professor of natural history—from 1875 to 1878. In 1878 she became professor of botany, and the college calendar for 1877–8, under the heading "Instruction in botany," outlines the subject-matter to be covered, and contains the following paragraph:

> Students are encouraged to make independent observations and self reliant researches; and, avoiding hasty inferences from partial data, to form judgments of things noted, and correctly describe the results of their observations. To secure this end, they are instructed in the best methods of study and observation.

That is a rather remarkable statement, considering the year in which it was published, and is evidence that Wellesley College was one of the pioneers not only in having a separate department of botany, but in emphasizing that something should be acquired by the study of botany besides information about plants, and in introducing the laboratory method of instruction in undergraduate courses.

Harvard appears to have been (in 1872) the first American college to introduce laboratory work in undergraduate instruction in botany. The following year Professor Charles E. Bessey required laboratory

[3] The Catalogue of the Troy Female Seminary for 1839–40 specifies an additional special charge of three dollars a term for students taking botany. This appears to be one of the early instances in America (if not the earliest) of a laboratory fee in botany.

[4] Her name appeared in the *Thirty-ninth Annual Catalogue (1875–76)* as Miss Etta E. Hooker.

work in the undergraduate courses at the Iowa Agricultural College, at Ames, without knowing that this had been done the year before at Harvard. Wellesley, therefore, was among the very first colleges in the world to adopt in undergraduate botanical instruction the only rational method of education in any science.

Appleton's "American Cyclopaedia," edition of 1881, in the article "Wellesley College," states that:

> The grounds comprise 300 acres, including a greenhouse, from which the students are supplied with flowers for their botanical researches.

Further on, in the same article, we read that,

> Wellesley College was established to give young women opportunities for a collegiate education fully equal to those provided for young men. It is arranged for collegiate methods of instruction only, and *for courses of difficult study.*

From the italic words it is evident that botany was no snap; but in the presence of my contemporaries—both students and teachers—I will not dwell on the continuity of this reputation, so splendidly maintained from the beginning until the present moment.

This period should not be passed over without a word of appreciation of the substantial pioneer work of Professor Hallowell, so fittingly commemorated during the current year by the endowment of the Susan M. Hallowell chair of botany.

I am still full of the enthusiasm engendered by my visit one year ago through the botanic garden and arboretum of Wellesley College. What a magnificent opportunity would have been lost if a portion of this beautiful campus had not been set apart for a botanic garden! The opportunity amounted to an obligation; the plan is admirable, and the present accomplishment a matter for congratulation, not only to the department of botany, but to the college as a whole, to the local community and to the botanical world.

When one contemplates the unique educational values of museums and botanic gardens, it seems strange indeed that they have, in America at least, almost without exception, developed independently of colleges and universities. In the old world, botanic gardens commonly developed as adjuncts to university botanical instruction—as at Pisa, Genoa, Amsterdam, Oxford, Cambridge and elsewhere; but even in the old world the outstanding botanic gardens developed as institutions wholly or largely independent of colleges, as, for example, the Chelsea Physic Garden, the Jardin des Plantes and the gardens at Berlin, Kew and Buitenzorg. In America the botanic garden of John Bartram (Philadelphia, about 1730), the Elgin Botanic Garden of Dr. David Hosack (New York, about 1801), the new California Botanic Garden (established this year), and the Missouri, New York and Brooklyn gardens, all developed as independent institutions, although affiliations have been established between the last three and local universities. Among university and college botanic gardens may be mentioned those at Harvard, the University of Pennsylvania, the Johns Hopkins University, Michigan Agricultural College, and more recently those at the University of Michigan and Stanford University. Among women's colleges the botanic gardens of Smith and Mount Holyoke are perhaps most widely known.

One of the best wishes I can give for Wellesley College is the early and vigorous development of its botanic garden and arboretum, and the organization of its courses of instruction in a way to make the fullest use of them.

Out of his wisdom and wealth, Aristotle endowed (at Athens) the first botanic garden of which we have record. From that day to the establishment of the Brooklyn Botanic Garden in 1910, the endowers of botanic gardens appear to have been men. The fashion of women benefactors, set by Brooklyn, soon began to spread. In 1914 Miss Susan Minns, of Boston, a student (together with Miss Hallowell) of Agassiz and of Gray, made a contribution of $50,000 toward the construction of a new botany building. This fund had increased to $80,000 by the time the new building was begun. In 1921 Mrs. Cordenio A. Severance (after the death of her husband) generously doubled an endowment fund which Mr. and Mrs. Severance had previously given for the botanic garden, now known as the Alexandra Botanic Garden, in memory of their daughter, the total endowment being $30,000.

In 1923 Mrs. Robert Shaw, of Wellesley, gave to the college a substantial fund in memory of her father as an endowment for the Horatio Hollis Hunnewell Arboretum, and additional funds for the initial work of development. In June of this year (1927), Miss Minns made another liberal gift of $11,000 as an endowment fund for the Hallowell Memorial Library, wisely specifying that the income from this fund is to supplement, but not to replace, the annual appropriation from other college funds for the botanical library. Mention should also be made of the recent generous gift of Dr. John Farwell of $100,000, to establish, in memory of his wife, the Ruby Frances Howe Farwell chair of botany.

To announce these facts here and now is taking coals to Newcastle, but to one who, like the speaker, has devoted much of his time and effort for a number of years endeavoring to secure more nearly adequate funds for botanical science, it is a source of gratification and pride to proclaim such benefactions as these.

Lest any one may feel that I am wandering from the dedication of the new building, let me emphasize the fact that a botanic garden is indispensable for the highest accomplishment in the work for which this building is intended.

The Elgin Botanic Garden, to which I referred a moment ago, was one of the earliest botanic gardens in America. It was established and maintained by Dr. David Hosack immediately after his appointment, in 1795, as the successor to Dr. Samuel L. Mitchill, the first professor of botany in Columbia College. In a pamphlet on "The establishment and progress of the Elgin Botanic Garden (New York, 1811), Dr. Hosack quotes from the *Transactions* of the New York State Agricultural Society for 1794, as follows:

> The establishment of a garden is nearly [i.e., closely] connected with the professorship of botany under the college, and the lectures on that branch must be always very lame and defective without one.

Then, referring to his appointment as professor of botany, he continues:

> I now readily perceive that an abstract account of the principles of these sciences (botany and materia medica), as taught by books, coloured engravings, or even with the advantages of an herbarium must necessarily be very imperfect and unsatisfactory, when compared with the examination of living plants, growing in their proper soils, with the advantages of culture; that a study, in itself both highly useful and agreeable, was necessarily rendered uninviting from the manner in which its principles were illustrated, and that a botanical establishment was indispensably necessary in order to teach this branch of medical science with complete effect.

After endeavoring to teach botany for two years and a half without a botanic garden, Dr. Hosack, in November, 1797, presented a memorial to the president and board of trustees of Columbia College, urging them to provide a botanic garden. "Since I have had the honour of an appointment to this professorship," he said, "it has been to me a source of great regret that the want of a *Botanical Garden*, and an extensive Botanical Library, have prevented that advancement in the interests of the institution which might reasonably have been expected."

In these quotations we find not only the germ of the once famous Elgin Botanic Garden, but one of the earliest expressions in America of the great importance of a botanic garden for the most effective teaching of botany.

It were possible, to be sure, to lay out this or any other college campus purely from the standpoint of beautiful landscape effect without any regard whatever for the botanical affinities of the trees and shrubs, or the accomplishment of any but esthetic results. And beauty, of itself, is educative. But there is a type of beauty often lost sight of by artists (or by those who are merely artists), which consists in the perfect adaptation of a thing to its uses (such, for example, as the perfection of the floral mechanism of orchids to secure insect pollination), or the utilization of a thing to the full extent of its capacities (such, for example, as the playing of an organ by a master). One who comprehends the morphology of an orchid flower can see in it immeasurably more beauty than one who sees it only as a pleasing combination of color and form. So a college campus, laid out as a botanic garden without sacrificing its landscape effects may serve science and art and education. It possesses a manifold beauty because it serves a multiplicity of ends. And it would seem almost incredible that an educational institution should not be keenly interested to make its campus (as well as its buildings) yield the fullest possible educational returns.

But what *is* the purpose of this building? "For the teaching of botany," you say. Emphatically, no! It will be used for that, but its purpose is education through botany. One of the greatest of modern fallacies is the idea that students go to college primarily to learn. (I am told that this fallacy now has few adherents in the student bodies themselves!) This idea underlies all the present-day talk about vocational training in our colleges. Four years of college should contribute toward fitting graduates to follow successfully some vocation, but the chief purpose of our undergraduate liberal arts college is to educate; education and learning or training are not synonymous.

Just as the purpose of the college is to educate, so the ultimate purpose of every course of instruction in every subject should be the education of those who pursue the subject. To learn about plants is one thing; education through botany is quite a different matter, a more serious matter, a vastly more important matter. How completely this conception of the function of botany in college instruction was recognized in Professor Hallowell's 1878 announcement, quoted above! This department of botany and this college may well be proud of that statement.

I shall not vie with Spencer and Huxley and others in attempting to define education, but it is a self-evident truth (except to those who lose sight of it!) that one may be a walking cyclopedia of information about plants, and yet, every time he writes, or enters into conversation, or passes judgment (so-called), or states his opinion, or evaluates issues, or discloses his taste, or reveals his understanding (or the lack of it) of the relation of botanical knowledge to knowledge as a whole, and its significance in the history of civilization and in modern life, he may reveal a lack

of education more clearly than he reveals his knowledge of plants.

If this building is to be devoted only to teaching people botany, the money could have been better expended; if it is to be devoted to education through botany, the money could not have been spent to better purpose.

What are the educational values to be derived by the study of botany? In the first place, the student will learn whether or not botany is his major interest in life. This is the most important and most vital question to be answered by the four undergraduate years of college. "What is my major life interest?" Not until this question is satisfactorily answered can the most effective education even begin.

I had the pleasure of teaching beginning botany for about ten years, and after a few preliminary years, while I was learning much more than I was teaching, I began to say to the students, at the last meeting of the class, something like this:

> I know perfectly well that some of you are delighted beyond words that this is the last meeting of the class, and that you will never take another botany course, nor read another book on botany, nor ever again glance at a plant except as an object of beauty, so long as you live, if you can avoid it. If you have discovered that this is your attitude toward botany, you could not have made a more vital discovery. The next most important thing for you to find out is this: "What subject does appeal to you more than any other, so that you shall want to elect all of it you are allowed to in college, and devote the best of yourself to its pursuit thereafter."
>
> Some of you have discovered that, until you began the study of botany, you were never really interested in anything before. You thought you had been interested, but you find you were mistaken. Your keenest regret is that the course is over, and you mean to elect all you have time for in college, to specialize in some branch of botanical science for your major post-graduate study, and to devote your life to the study and teaching of botany. You, too, are to be congratulated, not because you have discovered that botany is your life interest, but because you have discovered what your major interest in life is.

More surprised classes I never saw than those who listened to that statement. Congratulations from the "Prof" that they find they do not like his subject! One who is merely giving instruction in botany could never see his work from that angle; one who teaches botany as an educational discipline could never see it from any other. The former always regards his introductory course merely as a preparation for advanced courses; the latter regards it as an introduction of a developing mind to a new realm of thought, which may or may not make a strong appeal. But a course planned with the latter thought in mind should and will serve as one of the best possible preparations for advanced courses, should his students wish to elect them.

In common with other sciences, botany when properly taught is also peculiarly fitted for teaching people *how* to acquire knowledge and *how* to think. As I have emphasized elsewhere, the great lesson to be learned from the recent science-and-theology flare-up is that most people do not know *how* to think. They hold firmly to opinions and cherish prejudices, but they have not the most elementary conception of how a scientist proceeds in the acquisition of knowledge and the formulation of general notions and principles.

Again the ramifications of botany into other sciences, and into non-scientific disciplines, such as history, art, religion, social customs, commerce, literature, and others, qualify it to be, if one desires, a central motive in a program of education. For example:

The most widely disseminated of all human races has, for several thousand years, celebrated a feast with unleavened bread because its ancesters, on one of their famous racial migrations set out on their journey so hastily that they forgot to take with them a supply of tiny microscopic plants, without which bread is unleavened. An entire nation of American Indians has developed its culture around the Indian corn or Maize as a motive. The culture of another group centers around the acorn.[5] The cultivation of plants marks the beginning of fixed habitations, an absolutely essential condition for the development of civilization. The growing of cultivated plants is the foundation of industry and commerce. One can not follow out the botany of the objects in any living-room without being brought into contact with nearly every continent and nearly every clime. For botany is more than morphology and physiology, taxonomy and ecology, anatomy and cytology. The study of botany and the history of botany would afford as liberal an education as the study of any "five-foot shelf of books," and would afford certain educational results that could never be obtained by the reading of any number of lineal feet of printed matter.

Why is it that the history of botany (and of other sciences, for that matter) is so seldom taught in our colleges? What an educational opportunity is being missed! To one who knows the fascinating interest of the subject, its cultural value, the importance of its lessons for everyday thinking and judging, and the flood of light which it throws on modern science

[5] Two interesting rooms in the Brooklyn Museum are devoted to exhibits illustrating these two types of primitive culture.

and other departments of thought, the general neglect of the history of science in our educational programs is difficult to understand. In the Wellesley College *Calendar* for 1926–1927 courses of instruction are listed in 27 disciplines, of which 18 are non-scientific and 8 scientific. With the exception of Logic and Psychology, Philosophy, Reading and Speaking, and Spanish, courses in the history of the various subjects are offered in all the non-scientific disciplines, varying in proportion from 9 historical courses out of 11 in Art to one historical course out of 45 in Physical Education. In Mathematics one course out of 18 is historical. The department of History offers courses in almost every aspect of human activity, but no course in the history of science. However, such courses belong properly under the various sciences.

In the eight natural and physical sciences, historical courses are offered only in astronomy.

These data are assembled from the Wellesley College Catalog, not with any thought of criticism, but merely as the most appropriate concrete example (on this occasion) of a condition which is almost universal in American collegiate education.

The fact emerges that our colleges are neglecting one of the most valuable aspects of human thought and endeavor, and science is needlessly impoverishing itself as an educational discipline. Will Wellesley College not wish to be one of the leaders in correcting this educational defect, just as it was a leader in its early years in the introduction of laboratory work, and in other aspects of higher education?

Not more than fifty years ago, when science was only an entering wedge in the college curriculum, the protagonists of the older disciplines were accustomed to speak of the classics and other non-scientific studies as "the humanities" in contrast to the sciences, which were not then recognized as possessing humanistic values. But in 1919 Sir William Osler, Regius Professor of Medicine at Oxford, delivered his presidential address before the Classical Association. In this address on "The Old Humanities and the New Sciences," Osler elaborated the humanistic value of scientific studies in a program of education. "Our wonder at the extent and variety of the knowledge demanded by the school of *Literae Humaniores,"* says Sir William, "pales before the gasping astonishment of what is not there. Now and again a hint, a reference, a recognition, but the moving forces which have made the modern world are simply ignored. Yet they are all Hellenic, all part and parcel of the humanities in the true sense, and all of prime importance in modern education."

Possibly, as Osler suggests, the elimination of most of the science from the classical curriculum is due to the fact that the intellectual treasures of Greece and Rome were transmitted to us through ecclesiastical conduits and sieves, and only that was allowed to pass which was considered of interest and importance. Whatever the explanation, the classical student is incredulous (if not indifferent) when told that Aristotle founded the first botanic garden of which there is record, that he endowed it in his will, and that he was primarily a biologist. Those of us who prepared for our scientific careers by four or more years of classical studies in the last quarter of the nineteenth century learned almost everything of Theophrastus, a pupil of Aristotle's, *except* that he was, in the judgment of some writers, the founder of modern botany, and the director of the botanic garden established at Athens by Aristotle.

I refer to these facts because they emphasize in a striking way that, if we follow out the history of such a science as botany, we are taken straight to the heart of the old humanities; the cleavage between the sciences and the humanities vanishes—the sciences become humanities.

Says a recent writer in the English periodical, *Nature:*

"As a medium of culture, the history of scientific discovery opens up to the imagination vistas of man's endeavor which place it in the front rank of humanistic studies. *But,"* he continues," we doubt, however, whether much of the science teaching in schools, either primary or secondary, could be regarded as science for citizenship instead of science for specialists, and we should welcome a movement which would broaden its scope and change its character."

Here is the great opportunity for the liberal arts colleges, such as Wellesley, to regard the purpose of most of their courses to be primarily the *education* of their students, not the training of specialists. There is perhaps no greater need in our nation to-day than men of broad, scholarly education, whether or not they possess in addition the technical training fitting them for some profession.[6]

And now I have tried your powers of endurance and courtesy to the very limit, with scarcely a word about research. In the back of my own mind research has been taken for granted as the indispensable foundation and inspiration of teaching. How can one teach who isn't a student? He could only hear recitations—or, what is worse, give lectures—when he ought to be inspiring others to study. If one wishes to get a real thrill, let him discover a new fact or principle. We are all familiar with the classic story

[6] The educational importance of the history of science is emphasized in Paper No. 8 of the Report by the Adult Education Committee of the Board of Education, entitled, "Natural Science in Adult Education," London, 1927.

of Archimedes, running fresh from his bath through the streets of Syracuse, shouting *"Eureka, eureka,"* in his joy at having discovered the principle of specific gravity. We are told that Newton was so overcome with emotion, when he saw that his calculations on gravitation were confirming his hypothesis, that he could hardly hold the pencil to finish the equations. When Pasteur showed Biot how to make dextro-tartaric and laevo-tartaric acid, Biot exclaimed, "My dear boy, I have loved the sciences so much all my life that what you show me makes my heart thump." When Davy discovered the metal potassium he danced about his laboratory in high glee, and was too excited to continue his experiments.

The best thing I can wish for this building is that its laboratories may be the scene of many heart thumps (over science!), and of many ecstatic dances (over the discovery of truth!).

Wellesley is a college, but that is no reason why the teaching which is, perhaps, its main function, should not rest upon the solid foundation of research in progress. It is a truism that nothing is more wholesome for a college nor more stimulating to a student than an atmosphere of research penetrating laboratories and classrooms and campus. Nothing could be more unfortunate, from the standpoint of education, than to have a student, after four years of undergraduate residence, leave a college with the impression that any department of knowledge, and in particular, any science, is static—a finished product.

It was Frederick the Great who said: "The greatest and noblest pleasure which men can have in this world is to discover new truths; and the next is to shake off old prejudices." What a wonderful privilege to be able to study and teach! What a fine thing it is to provide a building and equipment devoted to the advancement of science and of education through science!

I congratulate this Department of Botany, I congratulate Wellesley College, I congratulate the botanical and educational world on this splendid opportunity and the correspondingly great responsibility.

C. STUART GAGER

BROOKLYN BOTANIC GARDEN

NEUROLOGY AND THE TEACHING OF MEDICINE[1]

To be the orator of the day on an occasion as important as this is to feel at once uplifted and cast down; by the honor one is raised, and by the sense of inferiority one is made to realize that indeed one is much lower than the angels. Graduates in the humanities, you, our new friends, are Freshmen in medicine—some of you have come because throughout your life you have been shapen in medicine, you have felt a driving urge which bade you examine the living things around you, be interested in the vagaries of the people you knew—may be, however, some have chosen this arduous trade because their fathers before them plied it and they count on his name and favor as aid and comfort for the hard launching in a not entirely appreciative world. A handicap this almost —for the spirit of practice comes only from within; an aptitude, a power to learn, may be inherited but to try to follow exactly the steps of one's father is perhaps to court the fate of Icarus. The wings with subtly-blended wax fastened on his shoulders were those which his father Daedalus had fashioned and by them he had been borne aloft. These wings lifted the ambitious Icarus, but the sun, you remember, melted the wax and he fell into the Aegean Sea—so the adventure and attrition of Practice may be the solvent of such wings; for it is the man himself, his sure selection of essentials, his ready grasp of problems, the skill of his hands, his humor, his instinct for the problems of others rather than his own, his love of the weakness of humanity as well as its strength; his pity for frail, great-brained, great-hearted, things like ourselves caught in the wheels and hammers of biological law. These are inborn and can not be transferred by will or directed in action—and they are the very stuff of happy and useful living. Those men who have a call for medicine have these qualities or most of them, but to those who doubt themselves—and who does not?—we would say that hard work will bring greater results here unaided by great brilliance of intellect than in any other profession.

Do you remember how Lydgate found that he must go doctoring—this in George Eliot's novel "Middlemarch":

One vacation, a wet day sent him to the small home-library, to hunt once more for a book which might have some freshness for him; in vain! unless indeed he took down a dusty row of volumes with grey paper backs and dingy labels—the volumes of an old Cyclopedia which he had never disturbed. The page he opened on was under the head of anatomy and the first passage that drew his eyes was on the valves of the heart. He was not much acquainted with valves of any sort but he knew that valvae were folding doors, and through this crevice came a sudden light startling him with his first vivid notion of finely adapted mechanism in the human frame. The moment of vocation had come, and before he got down from his chair, the world was made

[1] An address at the opening of session, September, 1927, Cornell University Medical College, New York City.

new to him by a presentment of endless processes filling the vast spaces planked out of his sight by that wordy ignorance which he had supposed to be knowledge. From that hour, Lydgate felt the growth of an intellectual passion.

Again we read of him—showing that this passion touched—as it must touch—his feelings as his mind.

His scientific interest soon took the form of a professional enthusiasm. He carried to his studies in London, Edinburgh and Paris, the conviction that the medical profession as it might be was the finest in the world; presenting the most perfect interchange between science and art; offering the most direct alliance between intellectual conquest and the social good. Lydgate's nature demanded this combination; he was an emotional creature, with a flesh and blood sense of fellowship which withstood all the abstractions of special study. He cared not only for "cases" but for John and Elizabeth, especially Elizabeth.

It was my good fortune as a recent graduate in medicine to come into close contact with some of the greatest minds in English neurology—and many of them like Ferrier, Gowers and Hughlings Jackson, with the later brilliant aid of Victor Horsley, had been notable builders of our science in the latter part of the last century. It is not easy for us to realize that when they began their work, knowledge of the functions of the brain and spinal cord was very little greater than had obtained since Grecian and Roman times. Their labors were crowned with marvelous results in the course of fifty years—but their work was necessarily of the nature of adventurous engineers—they gathered the materials for the building, they collected the stones and cement; Jackson, of whom it was said that his guess was worth ten men's facts, might be described as an architect of flying buttresses', Ferrier dug foundations, fortified the true walls of Jackson's theories and dynamited weak fabrications—Gowers writing the "Bible of Clinical Neurology" in inimitable prose when still under forty-five wore down his health and added not much to his fortune by the erection of mighty arches and the giving of form and meaning to the whole. Not all the work of their hands remained standing—here a pillar and there a weak foundation has crumbled and worn down, but on the whole we have a good home over our heads, to be builded higher and stronger by succeeding generations. In the nature of things, however, these men had to be collectors—anatomical facts cemented by meager physiology—they had to catalogue and classify new diseases and give names to symptoms and habitations to observed phenomena. They had always to be collecting and listing and ordering new specimens, and their interests lay naturally with those specimens most easily recognized as being different from normal —and such specimens were the end products of disease. We are now less interested in states of advanced deterioration and more concerned with the earliest departures from smooth working. We have come to understand how meagerly we know the normal and how necessary it is to grasp the infinite variety of natural regular processes in the organism. Problems in the natural history of disease are now more engrossing than the disease itself—we are more concerned for instance with the pathways of infection of the central nervous system than we are in neat descriptions of hopelessly paralyzed muscles resulting therefrom. This digging after roots deep in the ground is tough unproductive looking work—we have almost lost interest in the flowers and shrubs on the surface—and, for a while, less spectacular results may be available for show. This search for prime causes has also changed or rather better adjusted our value as a single specialty—added knowledge has revealed our unity with general medicine—we are discontented with labeling a disease "subacute combined sclerosis of the spinal cord"—we must find out its affiliations with pernicious anemia and with antecedent gall-bladder disorder. Epilepsy has ceased to be a diagnosis and has become a damning verdict—we must try to find the toxic factors which give rise to epileptic phenomena, which is now looked on as but congeries of symptoms produced by other agents.

This change from the static to the dynamic viewpoint makes cells on biochemistry, endocrinology, psychology and, as ever, on anatomy and physiology. These sciences, too, must in their turn be made more dynamic, more vital, more human. Twenty years ago, descriptive anatomy and amphibian physiology were the total vogue—much progress has been made since then—but there is still a divorce between the so-called pure sciences and medicine and surgery. The student of physiology should *as such* be familiar with normal heart sounds, with the normal fundus of the eye, with the appearance of the vocal cords in action—he may know the oculo-motor nerve of the eye, but what has he seen of convergence, accommodation or pupillary reactions? In short, there should be more physiology in the wards, and more humanity in the laboratory and the dissecting room. The normal must be made manifest, handled, seen, recognized, understood, before the abnormal can be appreciated —we must know truth before we know error—and we must know that there is no absolute in either. Was it not jesting Pilate, two thousand years ago, asked what is truth and did not stay for an answer? But he referred to ethics, not muscles and nerve tracts—and truth of function *can* be reached if a student study muscles in action, then dissect them,

and *about the same time* be shown them paralyzed by both a lower and upper motor neuron lesion. The X-ray department can be used to supplement physiological demonstration of digestion and heart mechanism. The instruments of clinical precision should be familiar and usable long before they are employed to detect the presence of disease.

The ophthalmoscope, the stethoscope, the laryngoscope, the otoscope, the blood-pressure apparatus, give up physiological secrets which must be mastered before those of medicine can be comprehended. Neurological cases often afford better examples of normal and abnormal function than any animal experiment in a laboratory—and coordinated education can make readily available all such material for students of the basic sciences.

The undergraduate in medicine then would have more time in the hospital to learn the very difficult art of history taking; the probing of the earliest manifestation of disease; he would grow more easy in the handling of his human charges—he would in short be more valuable in the search after first causes—more able to play his part in the open mobile warfare of the present day medicine and less of a static cataloguing agent in the trench warfare of the past. We don't yet know if man is energy or a machine. We compromise between the ideas of Plato and Aristotle and call him a transformer of power. His nervous system is three dimensional—and some of us suspect it may yet be four! Dreams though compounded of past experiences may be shot through with aspiration; the discontent of man with himself and his works forever scourging him upward can not yet be seen with stains of gold and silver, though we know some of the defects of structure which forbid the expression and perhaps existence of such torturing impulses. The study of the brain tells the tale of our painful climbing from the depths, of the building and controlling our powers of perception and adaptation—and may be from these neuronic origins spring man's nobility and lyric ecstasy as well. You will learn in this university something of the substantial workings of human powers and processes, their continuity with those of all living creatures, and, may be, you will find that control of human breedings must precede betterment in human brains.

We bid you welcome as our comrades to carry on the torch given us by our teachers—the torch that lets us see clearly—Man, half brute, half angel, most wonderfully made in mechanism, whose spirit denies the universe itself as boundary.

Foster Kennedy

Cornell University Medical College

THE CELEBRATION OF THE CENTENARY OF MARCELIN BERTHELOT[1]

One of the axioms frequently expressed by Marcelin Berthelot is that "Science is essentially a collective endeavor and owes its progress to the efforts of a multitude of workers in all periods and of all nationalities, who by common agreement are associated in the search for truth and its application to the improvement of the conditions of man." A more succinct expression of this idea is that "Science reveals the persistence and the necessity of human collaboration. It impresses our heart and spirit with the vivifying notion of solidarity."

He advocated repeatedly the advantages to the progress of science of cordial relations among scientists and a mutual appreciation of the efforts of each. It was this precept which stimulated the common generous spirit exhibited at this first gathering in so many years of the chemists of all nations.

The organizers of the celebration desired that it should not be simply a passing ceremony without beneficial consequences. They wished to honor the memory of Berthelot in a manner which would prepetuate his ideals of service and the promotion of more friendly relations between all chemists. It was believed that the most fitting monument to him would be a house of chemistry which would serve as a meeting place not only for the chemists of France but for those of every country.

It was realized that an invitation to all nations to participate in its accomplishment would give to each a more personal interest in the enterprise. Furthermore, it was desired that those who might enjoy the benefits of the undertaking should regard themselves as constituent members and not as invited guests. This broad-minded point of view is more clearly appreciated when one considers the difference between an invitation to make use of the facilities provided by an organization and an offer of the privileges of membership in it.

Invitations were, therefore, addressed to all countries of the world to unite with France in celebrating the one hundredth anniversary of the birth of Marcelin Berthelot and to contribute any sum they might desire towards erecting a memorial to him in the form of an international house of chemistry. This invitation was accepted in the spirit in which it was sent by practically every nation and the ceremonies which I wish briefly to describe were held in Paris on October 24–26 last.

It is fitting, however, that attention should first be

1 Address delivered before the meeting of the Chemical Society of Washington, January 12, 1928.

rected to the thoroughness with which the celebra-
on was planned. The Berthelot committee was rmed a year or more in advance and the leading en of science and of the government accepted promi-ent places on it. There are probably few countries the world where science is so highly appreciated as France and the most complete support that a nation uld give such a movement was obtained.

The French subscription to the undertaking was ficially opened at a ceremony held at the Sorbonne n May 5. At that time representatives of the lead-g scientific and other national organizations pledged e support of each to the undertaking. Shortly there-ter the central committee began issuing regular bul-tins to the press reporting the subscriptions received. he total grew gradually from a few million francs more than ten millions and at the time of the cere-onies in October it had reached fifteen and a half illions, of which nearly seven had been received om countries other than France.

Those who have aided in preparing for national eetings know something of the difficulties which are ncountered. The impossibility of correctly estimat-g in advance the number likely to be present is very uch greater in the case of an international gathering. urthermore, the misunderstanding resulting from ifference in customs in different countries are much ore pronounced, and the consequence of any possible eglect of attention to a guest is far more serious han to a fellow countryman. Hence, one can readily magine the exceptional qualifications the Berthelot ommittee was called upon to exhibit. That they suc-ceeded admirably in their efforts is certainly the con-sensus of opinion of all who were fortunate enough to be present.

The opening function was a reception in the salons of the Sorbonne. Here one met previous acquaintances and quickly made new ones. The following day the delegates were invited to visit, at the École de Phar-macie, a collection of mementoes of Berthelot. Here was assembled the apparatus used by him in some of his most notable investigations, his manuscripts, note books and in general all kinds of souvenirs of his scientific activity.

From the École de Pharmacie every one proceeded to the Collège de France to visit the laboratory occu-pied by Berthelot during the last years of his life. Here the delegates were welcomed by M. Croiset, the administrator of the Collège de France. Since the laboratory and lecture hall were too small to contain the hundreds who were present the speakers addressed the assembly from a stand erected in the court yard. M Croiset said, "You have come to the Collège de France like pilgrims of the middle ages came to sanc-tuaries renowned by the virtues of a patron saint. As pilgrims of modern science you come to this house which has listened to the teachings of Marcelin Ber-thelot and which has been the witness of his fruitful meditations. You come both to render homage to a grand memory and to be inspired by a great example. The life of Berthelot is one on which it is particu-larly profitable to meditate." In continuing the speaker pointed out that Berthelot knew how greatly the exchange of ideas, intellectual collaboration and communications between scientists contribute to the development of the spirit of peace and friendship which is the guarantee of real progress.

Following M. Croiset, Professor Schlenck, director of the Chemical Institute of the University of Berlin, responded in the name of the German delegation. It should be remarked that Germany accepted in a very cordial manner the invitation to participate in the celebration and sent twelve of its leading chemists. Among these may be mentioned Nernst, Haber, Will-stätter, Neuberg, Bodenstein, Wieland, Markwald, Huttig and others whose names I failed to note. Pro-fessor Schlenck, speaking for the first time in France since the war, said that "Genius has its own roads which are indeed those of natural science and philoso-phy and all lead to the same end which is the en-nobling of humanity. This high aim is the object of all the sciences. It makes of the scientists of all lands the priests of the same temple and should unite them more ideally than any other human interest. This is why I see in the sciences a basis particularly favor-able for the mutual understanding of peoples and for the profound comprehension of the soul of each. The genius of Berthelot has had an incontestable influence in this direction and it is for this reason particularly that the German delegation renders special homage to his memory."

Following Professor Schlenck, our own Professor Bogert spoke in the name of all other foreign dele-gates. He said, "We are here as at the table of our older brother. The scientists of all countries are united thus as members of the same family and their only rivalry should be to do more and better work. Scien-tists have often been reproached for being a little de-tached from terrestrial things. However, it is in their work that the material and ideal unite and often the most complicated problems are solved in the most ele-mentary manner. The straight route followed by Berthelot does not deviate far from the throne of God."

The large gathering then paid a visit to the labora-tory, which will celebrate in three years the four hun-dredth anniversary of its founding. The amphitheater where Berthelot taught is an incomplete semi-circle with benches without backs rising in tiers. The worm-holed stairs give and squeak at each step. According

to present-day standards the laboratory is far from adequate for its purpose, but M. Moureu and his staff and students numbering about twenty still use it for research of a very high type. Like so many long-established laboratories in European countries the inspiration of historical associations compensates for the lack of modern conveniences.

After the visit to the laboratory, Dr. Baker, president of the Chemical Society of London, placed a wreath at the base of the statue of Berthelot which stands in front of the Collège de France.

There next followed the dedication of a tablet erected on the house in the rue Saint Martin where Berthelot lived from 1852–1861. The house, not far away, where he was born on October 25, 1827, had been demolished in city improvements and could not receive the distinction now paid to this later abode of the great scientist.

In the afternoon the city of Paris joined in the general homage paid to Berthelot by means of a reception held in the great halls of the Hotel de Ville. The addresses there emphasized the gratitude of the city to one of its most illustrious children. Son of a Parisian, born in the shadow of the city hall and passing his entire life in Paris, made it particularly fitting that the city should honor his memory.

In the evening there was held the most solemn function of all. This was the ceremony in the grand amphitheater of the Sorbonne, at which the contributions of Berthelot to science were extolled and the engrossed addresses of appreciation brought by the delegates from the learned institutions of the world were formally handed to M. Painlevé, the president of the Berthelot committee.

One half of the main central portion of the hall was occupied by the delegates from France and the other by those from foreign countries. The larger number were in their academic robes and wore their decorations. The various brilliant colors of these, the uniforms and glistening helmets of the municipal guard, the striking green costumes of the members of the academies, the elegant dresses of the ladies in the galleries and the flowers, flags and decorations, of which the central feature was a magnificent bust of Berthelot, all combined to make a wonderful scene. At nine o'clock, to the strains of the "Marseillaise," President Doumergue, of France, and his staff entered and took seats immediately in front of the estrade.

M. Painlevé first called upon M. Charles Moureu, who is the successor of Berthelot in the chair of chemistry at the Collège de France. He described in a most beautiful manner the chemical work of Berthelot. Tributes were then paid to Berthelot by M. Georges Lecomte, director of the French Academy; M. Lacroix, perpetual secretary of the Academy of Sciences, M. Wéry, president of the Academy of Agriculture, and M. Glay, president of the Academy of Medicine. Attention was especially directed to Berthelot's conception of science as a collective endeavor, an endless chain of which each one forges a link.

M. Hozda, Minister of Public Instruction of Czecho-Slovakia, next spoke in the name of the foreign delegations. In concluding his brilliant address he said, "From age to age France has emitted an enormous quantity of light, the reflection of which is seen on the faces of all nations. To this it should be added that the hearts of all nations radiate towards France the warmth of their admiration and appreciation."

After the music which followed the address of M. Hozda the list of the names of delegates who were bearers of addresses from the learned institutions of the world was read. These were called according to the alphabetical order of the names of each country and unexpectedly began with Abyssinia, Afghanistan, Algeria and later others, which one did not expect to find associated with the rest of the world in honoring a great chemist. When the name of the United States was reached addresses were carried forward for the American Chemical Society by Dr. Bogert, for the Washington Academy of Sciences by Dr. Tisdale, for Princeton University by Dr. Trowbridge, for Harvard University by Dr. James H. Woods, for the Mellon Institute by Dr. Weidlein and for the Johns Hopkins University by myself. There was indeed a very long procession and many brought voluminous testimonials and unusual marks of their esteem.

When the last bearer of an address had given it into the hands of M. Painlevé, he expressed in a most beautiful manner the thanks of France and of French science to the sixty nations for their collaboration in paying honor to Berthelot. In continuing, he said, the organizers of the centenary celebration in desiring to prolong the work and hopes of the grand departed have requested the aid of all the world in a humane enterprise, the erection of a house of chemistry, open to investigators of all countries and of all origins, where all might assemble and discuss freely their doctrines and find there collected the documents pertaining to every chemical question which might engage their attention.

In response to criticisms that had no doubt been brought to his attention, he said:

Have I need to rectify certain interpretations, certain misunderstandings which this generous project has provoked? Has one not accused the initiators of pretending to impose upon the development of chemistry a sort of domination which will be exercised by the medium of the center thus created? Ah! in what brain

f an infant could have been born this ambition of eatness, which would have been the laughing stock of e scientific world if ever it had been conceived? The tivity of the Maison de la Chimie will be more modest d otherwise fruitful. It will permit the doctrines, the eories, the schools the most diverse and the farthest parated, to know each other and to mix together for e greatest good of all, instead of inclosing themselves an isolation resulting from ignorance and pride.

The Maison de la Chimie will respond to the noble eal of solidarity and will be at the same time a factor n scientific progress and the bringing together of eoples. It will recall to those who may forget, that hemistry is not a destructive force but a benefactress. onsecrated to the science which received so vigorous an mpulse from him and to which he devoted his life, rected under his shield, the Maison de la Chimie will ear at its summit the name of Marcelin Berthelot. It s an honor of which he was worthy, and of a grander ne he did not dream.

The next morning at 10 o'clock a commemorative eremony was held at the Pantheon. This magnificent uilding is the hall of fame of France and in it are nterred the ashes of Marcelin Berthelot and his wife. Two addresses were given. The first of these was by he Prime Minister of France, M. Raymond Poincaré, who is also a distinguished mathematician and a member of the institute. This address exhibited a detailed knowledge of Berthelot's works, which would have done credit to a chemist. I regret that there is not time to quote it all because it exposes even more clearly than has been done by many of the chemists who have attempted it the brilliant researches of Berthelot. The portion referring to the Maison de la Chimie is, however, particularly beautiful and is as follows:

In this Maison which we are going to erect in honor and for the benefit of chemistry, the scientists of all lands will meet and learn to know each other better. They will find there a fireside where future civilization will be elaborated. To the science which they will there serve together they will open each day a larger field of experiences. They will demand of it an increase of the productivity of the soil, the amelioration of the conditions of agriculture and enrichment of the countryside. They will command it to make nutrition more healthful and normal, they will make of it an auxiliary of medicine and pharmacy, the councilor of therapeutics and of the clinic, the enlightened collaborator of public hygiene. They will enlarge its industrial mission, open the factories to it, assign to it the task of remaking and coloring textiles, of composing essences and carburants, of augmenting the general prosperity by the multiplication of indispensable products.

Many times it has come to me, I confess, to celebrate the disinterested character of science and even to extol research where all thought of practical application is eliminated. I am aware that there is nothing more beautiful than the continued effort of a scientist who pursues the truth, without personal preoccupation and who expects nothing from science but the satisfaction of cultivating it. But a scientist has also the duty of being a citizen in his country and a man in humanity. He should not withdraw himself from the society which surrounds him. He should not turn from those who suffer and who hope. The Maison de la Chimie will have its windows on the people in the street and will not shut its doors either to misery or to suffering. It will not be the abode of silence and of solitary thought; it will be the great workshop of life, of action, and of progress.

The other address was given by M. Gallardo, the Minister of Foreign Affairs of the Argentine Republic, who responded in the name of the foreign delegations. He extolled in the highest terms Berthelot's contributions to science and his noble character.

The ceremonies were interspersed with music and the entire setting and decorations, consisting of a large background bearing the name of Berthelot and flanked by two great illuminated torches, were most impressive. On leaving the Pantheon the delegates were transported in large motor cars to Versailles, where a banquet of 1,200 covers was held in the hall of battles of the palace and presided over by M. Herriot, Minister of Public Instruction in France.

The response in the name of the foreign delegates was here given by Professor Amé Pictet, of Switzerland. He expressed the gratitude felt by all towards French chemists and their government for the invitation to participate in the magnificent undertaking in honor of Berthelot. He expressed the sense of obligation universally felt for the benefactions which have come to all from the work of Berthelot. He called attention particularly to the fact that Berthelot had never drawn any personal benefit from his numerous discoveries. He likened Berthelot to a powerful lamp, such as is erected in large cities at the intersection of streets, in such a manner that each of the different arteries and those who live and work or pass through them may be benefitted by the light given out. "This is the rôle which Marcelin Berthelot has played in the great city of chemists. By the side, however, of the precious light there is a little free space, large enough that one has dreamed of constructing there a house, of which the corner-stone will be laid to-morrow. A better location could not have been chosen. Placed thus in full light, situated at the extremity of the roads which converge toward it, this house will be seen by all. By all the arteries which lead to it will arrive the materials needed for its construction and later there will arrive those who will occupy this sanctuary of science." Professor Pictet emphasized particularly that all countries had responded to the appeal of French science and that the assemblage was truly international. This he considered a capital point and a precious guarantee of the future of our sci-

ence. He concluded by saying, "I come in the name of all the foreign delegates to express to you our hopes for the success and prosperity of the future Maison de la Chimie."

M. Herriot then delivered a discourse which was frequently interrupted by the heartiest applause. He mentioned that of all the works of Berthelot, the most beautiful, without doubt, was his life. It abounded in seductive pictures. He referred to the comradeship between Berthelot and Renan, the great French writer and philosopher. His address described the work of Berthelot in the most poetical manner. It is remarkable that a person so occupied with the affairs of state as M. Herriot could have such a profound knowledge and appreciation of science. One of the most striking of his remarks was, "We thank him with respect for having proclaimed and demonstrated the candid sovereignty of the intelligence."

After the banquet the palace and gardens of Versailles were visited by the delegates and the grand fountains made to play especially for their pleasure.

In the evening the delegates were entertained at a gala performance at the opera.

The third day of the ceremonies, Wednesday, October 26, began at 10 o'clock with the laying of the corner-stone of the Maison de la Chimie.

The site which has been donated by the French government consists of a triangle bounded by the Avenue du President Wilson, the Avenue d'Jena and the Gardens of the Trocadero. The magnificent equestrian statue of George Washington is at the intersection of the two broad avenues. The beautiful Place des États Unis is a short distance away and the palatial new embassy purchased by the United States is directly across the Avenue d'Jena from the site. In the matter of the choice of a location a more delicate attention to the United States could not have been shown. The site is one of the most beautiful in the world and it is certain that the magnificent building to be erected on it will constitute a monument to chemistry such as has not hitherto been conceived.

The ceremonies were dignified and impressive. The first address was that of M. Donat Agache, president of the Société de Chimie industrielle, who spoke in the name of the French subscribers. He emphasized particularly the profoundly useful character of the undertaking. He pointed out that "In constructing the Maison de la Chimie, France sought no kind of hegemony, even scientific, but by the mutual aid and human collaboration in the domain of science wishes to realize the dream of Berthelot, that all the chemists of the world should unite their efforts and work to ameliorate the conditions of living, that their discoveries should lighten the physical efforts of work in the fields, the mines and factories, that their science would not again seek to produce toxic gases or horrible explosives; the chemistry of war, which if we do not take care might destroy civilization itself; but the pacific bodies: fertilizers, colors, fats, rubber, oils, fuels, all of which produced in abundance would make life more comfortable."

The next speaker was M. Zumeta, Minister to France from Venezuela, who spoke in the name of the foreign subscribers. Among the thoughts to which he gave expression was that "We take part in the laying of this first stone of a monument which is erected by the peoples of the earth, as an arch of alliance and as a fireside for investigators of all nations interested in the secrets of matter and desirous of unraveling them for the elevation, the glory and happiness of the human race." He also pointed out that the great thinker who is the object of this commemoration condensed in the most happy synthesis of his life the thought that "The triumph of science is to assure to men the maximum of morality and of happiness."

M. Ernst Cohen, president of the International Union of Pure and Applied Chemistry, said, "We other foreign chemists have been profoundly touched by these ceremonies. We will return to our countries persuaded that science is an endeavor essentially collective." He then translated into several languages the words of Berthelot expressing this idea, and terminated by the hope that this noble thought of a French scientist might be engraved in our souls as well as on the façade of the Maison de la Chimie.

M. Jean Gérard, secretary of the Berthelot committee, then read the list of subscriptions received from 41 countries, showing a total of 15,538,940 francs.

M. Herriot in his final remarks thanked the donors and mentioned that international conciliations founded on science are in the image of those which Berthelot wished to see realized for the happiness of men. Chemistry, he said, is an all-powerful science which even encircles the mystery of life. The advancement of chemistry is not an academic divertisement but the affirmation of the profound ties which unite peoples. He pointed out that this reunion in its simplicity marks a date in the history of humanity. It is an act of faith.

Those present then gathered around the block of stone which was to be the first of the Maison de la Chimie and M. Herriot carefully sealed in it the iron box containing the manuscripts which, as said by a writer in one of the newspapers of Paris, would show to future generations that there was an hour when men swore to love each other.

Following the laying of the corner-stone the delegates were invited to Chantilly for luncheon and a visit to the magnificent Chateau which is now the property of the Institute of France. The ceremonies

were brought to a close by a reception in the evening at the Elysée Palace tendered by M. Doumergue, the President of France.

In conclusion I regret to mention that the pleasure of the American delegates in their participation in the ceremonies was marred somewhat by the action which had been taken in September by the Council of the American Chemical Society in regard to the Maison de la Chimie. Although this was evidently based upon a misunderstanding, it was rightly regarded as an unjust criticism of the project. The mistaken basis of that action was undoubtedly a confusion in the minds of some between the proposed International Office of Chemistry and the Maison de la Chimie. The two are not identical.

Although from the American point of view there may be worthy arguments against participation in an international office of chemistry, there can certainly be no just criticism of the kind of Maison de la Chimie which is to be erected in honor of Marcelin Berthelot. This, as repeatedly emphasized by its sponsors and many friends, is a beneficent enterprise having for its object the advancement of chemistry and the promotion of good-will between the nations of the world.

Atherton Seidell

Hygienic Laboratory,
Washington, D. C.

SCIENTIFIC EVENTS

AN INTERNATIONAL CONVENTION ON CANCER RESEARCH

At the quarterly meeting of the grand council of the British Empire Cancer Campaign, held on January 10, under the presidency of Sir John Bland-Sutton, it was announced that an International Convention on Cancer Research was being convened for next July in London, and that the Royal Society of Medicine had placed their headquarters at the disposal of the British Empire Cancer Campaign for the purposes of the meetings of the convention. Sir J. Bland-Sutton, past-president of the Royal College of Surgeons and vice-chairman of the campaign, has been appointed president of the convention.

The London *Times* reports that the convention committee, charged with the arrangements, informed the grand council that the work of the convention would be divided into the following sections: Pathological, diagnosis, medical treatment, surgical treatment, radiological treatment and public health and statistics. Chairmen had been appointed for some of these sections: Sir Thomas Horder, with Sir William Willcox as vice-chairman, of diagnosis section; Professor Lazarus-Barlow, pathological section; Sir Charles Gordon-Watson, surgical treatment section; Professor Sidney Russ, with Dr. Robert Knox as vice-chairman, radiological treatment section, and Lieutenant-Colonel F. E. Fremantle, public health and statistics section.

Invitations are being sent to all parts of the world to those whose names are closely associated with modern research into the cancer problem, and all the universities and medical schools of the United Kingdom will be invited to send delegates to the convention. The chairman of the convention committee, Mr. J. P. Lockhart-Mummery, reported that Sir Richard Garton, chairman of the finance committee, was making a generous donation towards the expenses of the convention and that no part of the campaign's funds would be used in connection with it.

Sir Richard Garton, in submitting the report of the finance committee, announced that a trust fund had been created by the executors of the late Mr. William Johnston, of Liverpool, to be known as "the Aileen Congreve Memorial Fund," which amounted to a sum of £18,147. Of this amount £16,000 will become a permanent trust, the interest on it being applied to cancer research work in Liverpool, through the scientific committee set up in connection with the Lancashire, Cheshire and North Wales Council of the British Empire Cancer Campaign, now in process of formation. The chairman of the finance committee also reported that an anonymous donation of £10,000 had been received by the campaign through Sir Basil Mayhew, auditor to the campaign, and that the interest on such fund would be available for the general research work fund of the campaign.

THE PROPOSED PAN-AMERICAN GEODETIC INSTITUTE

The Mexican delegation to the Pan-American Conference has submitted a plan for the organization of a Pan-American Geodetic Institute.

In a review of the history of the science of geography the Mexican delegation introduced a report prepared by the department of agriculture and public works of the government of Mexico in which great emphasis is placed on the fact that the existing world geographical institution, known as the International Council of Investigators, does not suffice for solution of the localized problems of America.

Functions of the proposed institute, the location of which is to be later decided by the nations, are detailed as follows:

1. The coordination, distribution and propagation of geographical studies in American states.
2. It shall serve as an organization of cooperation among the geographical institutes of America, in order to facilitate the study of geographical problems.
3. It shall carry out and coordinate investigations call-

ing for the cooperation of several countries and control of scientific investigations.

4. It shall be entrusted with the publication of all reports ordered by the American states.

5. It shall participate in the study of frontiers, in order to facilitate the acceptance of the natural nature of a geographical character and serve as an intermediary between American states for a better understanding between them.

6. It shall be in charge of the formation of an archive comprising maps of the entire American continent, classified by countries as well as by libraries, containing all the geographical works published by American states.

The plan was later approved by the Pan-American conference in plenary session. It proposes an ambitious central organization in an American capital to be chosen by lot, with affiliated organizations in all new world republics contributing to its store of knowledge.

Each government would appoint one member who shall have been an active geographer in the service of his country. The number of votes appertaining to each delegate and the quotas due from each country for the maintenance of the institute would both be computed on the basis of population of each republic compared to the total population of all the nations represented.

NEW BUILDING FOR THE YALE SCHOOL OF MEDICINE

Plans for a new building for the Yale School of Medicine, costing $1,250,000 and consisting of an addition to the Anthony N. Brady memorial laboratory, have been announced at the university. The entire cost will be met by the General Education Board.

The construction began several months ago and it is now expected that the building will be completed by the beginning of the next school year. The total capacity is 1,600,000 cubic feet, which is 20 per cent. larger than the Sterling Hall of Medicine, which was built a few years ago.

The new building, at the corner of Cedar Street and Congress Avenue, is joined with the administration building of the New Haven General Hospital by a covered archway. Together with the existing wing of the Anthony N. Brady laboratory, built in 1917, the new building has a total cubic capacity of 2,200,000 cubic feet.

The ground floor of the Brady laboratory, which will be the entrance floor for students and workers in the new building, will be given over to locker and rest rooms. The first floor of the Brady laboratory will be occupied by the school of nursing for its administrative offices and classrooms.

The ground floor of the new Cedar Street wing, as well as that of the Congress Avenue wing, will be devoted to technical procedures essential for the work in the laboratory. Among these are the surgical pathology activities and a large well-equipped photographic establishment.

The first floor of the new wing on Cedar Street, as well as on Congress Avenue, and the second floor of the Congress Avenue wing are to be occupied by pathology. The whole of the second floor of the Cedar Street wing will be occupied by the department of public health, headed by Professor C.-E. A. Winslow. On the third floor of both the old and new wings on Cedar Street and the whole of the Congress Avenue wing on this floor will be located all of the university's activities in bacteriology.

The fourth floor of the Cedar Street wing contains a dormitory suite for the use of the staff in pathology and bacteriology, so that these men may be available at all times, not only to conduct time-consuming investigations, but also for emergency service, which their particular departments are frequently called upon to render.

THE 1929 BUDGET OF THE U. S. DEPARTMENT OF AGRICULTURE

The budget for the fiscal year 1929, transmitted by the president to congress on December 7, recommends total appropriations of $142,753,229 for the work of the U. S. Department of Agriculture for all purposes, including $77,500,000 for road construction. Items for which increases are allowed total $3,714,679, this figure being offset by reductions in other items aggregating $824,439. The budget recommends that $150,000 of the balance remaining from the $10,000,000 corn-borer control fund, provided by the act of February 23, 1927, be made available for a special research program designed to assist in meeting the situation arising out of the corn-borer infestation. Including the special fund for research in relation to the corn-borer situation, about $1,300,000 of the increases included in the budget is for research work by the Department of Agriculture.

An increase of $480,000 is recommended in the funds authorized by the Purnell Act for payments to the state experiment stations for agricultural research, or $10,000 additional for each of the 48 states, making a total of $3,840,000 to be available during 1929 for this purpose under the Hatch, Adams and Purnell Acts. An increase of $41,256 is recommended for extending the research work of the Bureau of Dairy Industry. Increases in several of the subappropriations of the Bureau of Animal Industry, aggregating $120,620, are recommended to provide for adjustments in the compensation of field veterinarians. A net increase of $495,180 is included for forestry,

including $200,000 for cooperation with states in fire suppression on state and privately owned timberlands, under the terms of the Clarke-McNary reforestation act. For effectively meeting the menace to the southern fruit industry presented by the occurrence of the Mexican fruit worm in Texas, the budget includes $34,100 for researches on this insect and $100,000 for control operations. An increase of $68,220 is included for developing and extending the agricultural outlook work, including researches on the fundamental economic principles underlying production and marketing, with a view to adjusting production to probable demand for farm products. For further developing the cooperative marketing work of the department an increase of $39,560 is provided. To further carry out the provisions of the act of March 3, 1927, authorizing the collection of statistics of the grade and staple length of cotton, an increase of $335,000 is included. An additional $34,820 is recommended for strengthening the port and border inspection in connection with the plant quarantine act, and $50,000 is provided for the control of pink bollworm of cotton in Arizona and New Mexico. For enforcing the milk import act of February 15, 1927, and the caustic poison act of March 4, 1927, $50,000 and $25,000, respectively, are recommended.

The budget recommends the creation of a unit in the department to be known as the plant quarantine and control administration, and the consolidation thereunder of all the regulatory and control activities affecting plants and plant products now conducted under the Federal Horticultural Board, the Bureau of Entomology and, to a slight extent, the Bureau of Plant Industry. The Bureau of Entomology, thus relieved from regulatory and control duties, will confine its activities to insect research projects, which present many pressing problems requiring attention, the solution of which, it is believed, will be materially advanced under the new arrangement.

SCIENTIFIC NOTES AND NEWS

The great Dutch mathematical physicist, Hendrik Antoon Lorentz, born in 1853 and appointed professor in the University of Leyden in 1878, died, according to a cablegram from Holland, on February 5. The death of Professor Lorentz was reported by cable to the newspapers as the issue of Science for last week was going to press and unfortunate errors in the notice were reproduced, the proof not having been read by the editor.

The American Society of Swedish Engineers has presented to Dr. E. F. W. Alexanderson, consulting engineer of the General Electric Company, the John Ericsson Medal for achievement in electrical engineering. The presentation was made at a dinner in Brooklyn on February 11.

Professor William Berryman Scott, oldest active professor in Princeton University, celebrated his seventieth birthday on February 12. In recognition of Dr. Scott's service to education and particularly to geological research, a dinner was given to him at the Nassau Club. Dr. Henry Fairfield Osborn, a former associate of Professor Scott at Princeton, was chairman of the committee which arranged for the dinner.

Professor Wheeler P. Davey, vice-dean of the school of chemistry and physics at the Pennsylvania State College, has been elected a fellow of the Institute of Physics of London.

The Cameron Prize, awarded by the University of Edinburgh to a person who, in the course of the five years immediately preceding, has made any highly important and valuable addition to practical therapeutics, has been awarded to Professor C. Levaditi, of the Pasteur Institute, Paris, for his work on the chemotherapy of syphilis and his other contributions to our knowledge of microbiology.

The Reale Accademia dei Lincei has elected Professor Giovanni Georgi, of the University of Cagliari, a correspondent in the section of mechanics, and Professor N. E. Nörlund, of the University of Copenhagen, a foreign member in the section of mathematics.

At the recent quarterly meeting of the council of the Royal College of Veterinary Surgeons, the diploma of honorary associate was conferred on Sir John McFadyean, late principal and dean of the Royal Veterinary College, London.

A gold medal has been awarded by the school of industrial art of the Pennsylvania Museum to Nicola D'Ascenzo, worker in stained glass. The presentation was made on the fiftieth anniversary of the founding of the school. This is the first year that the medal has been offered.

Previous to his recent return to the United States from China, Dr. Henry S. Houghton, dean of the State University of Iowa College of Medicine, was decorated with the Order of Chia Ho Chang for outstanding service in medical work in China. Dr. Houghton was presented at this time with a silver bowl inscribed with the names of the staff of the Peking Union Medical College, with which he had been connected for about nine years.

Professor Roswell C. Gibbs, professor of physics at Cornell University, has been elected president of Phi Kappa Phi, national honorary scholastic society.

Dr. Bashford Dean, professor of zoology in Columbia University and professor of fine arts in New York University, has resigned his curatorship of the department of arms and armor of the Metropolitan Museum of Art and has been elected a trustee to fill the vacancy caused by the death of Harry Payne Whitney.

Dr. George R. Minot, professor of clinical medicine at Harvard University, has been chosen to succeed the late Dr. Francis W. Peabody as director of the Thorndike Research Laboratory of the Boston City Hospital.

Edmund Heller, formerly on the staff of the Field Museum of Natural History, of Chicago, has been appointed director of the Milwaukee Zoological Park.

Carl Richter has been appointed curator of zoology at the Chamberlain Memorial Museum, Three Oaks, Michigan.

George A. Olson, agricultural director of The Gypsum Industries, Chicago, has resigned. Previous to going to Chicago, Mr. Olson was in charge of chemistry at the Washington Agricultural Experiment Station.

Arthur W. Gray has resigned as physicist of the Calco Chemical Company to become vice-president and director of research of Dielectric Products, Inc.

Dr. A. W. Miller, for the last ten years chief of the field-inspection division of the U. S. Bureau of Animal Industry, has been selected by Secretary Jardine to fill the position recently made vacant by the resignation of John T. Caine, 3rd, who was chief of the packers and stockyards division of the bureau.

Dr. Ethel Drever Simpson, of the Cornell Medical College in Ithaca, who has been granted a National Research Fellowship in Medicine, is the daughter of the late Sutherland Simpson, professor of physiology in Cornell University, and is to continue the researches she began with her father under the direction of Dr. John Tait, professor of physiology in McGill University, Montreal.

Nature states that, in consequence of the increased activity in oil-field investigation in Australia, and following the appointment of Dr. W. G. Woolnough as commonwealth geological adviser, the services of Mr. Frederick Chapman, of the British National Museum, have been lent to the commonwealth for a year as government paleontologist.

Sir James Colquhoun Irvine, principal and vice-chancellor of the University of St. Andrews, Scotland, has accepted an invitation to take a leading part in the Institute of Chemistry of the American Chemical Society which meets in Evanston, Illinois, from July 23 to August 18, 1928. Sir James was the principal European guest at the chemical sessions of the Institute of Politics at Williamstown in 1926, when the idea of an Institute of Chemistry was first conceived.

Professor Constantin Carathéodory, of the University of Munich, who is visiting the United States as the first visiting lecturer of the American Mathematical Society, has completed a series of lectures at a number of American universities. Professor Carathéodory is now in residence at Harvard University. Arrangements for additional lectures will be announced later.

Dr. Paul Alexandroff, of Moscow, and Dr. Heinze Hopf, of Berlin, have been granted International Education Board fellowships for 1927–28, for the purpose of becoming acquainted with the work of American mathematicians in the field of analysis situs. They are studying at Princeton and Harvard.

Dr. D. C. Carpenter, associate in research chemistry at the New York State Agricultural Station, has been granted a year's leave of absence for study in the laboratory of Dr. T. Svedberg, at the University of Upsala. Dr. Carpenter is traveling under the auspices of the International Education Board, and will visit laboratories in Copenhagen, Berlin, Leipzig, Halle, Stuttgart, Munich and Vienna.

Professor Thomas F. Cooke, of the department of physics of the University of Buffalo, and Mrs. Cooke sailed on January 21 from New York for the Mediterranean. They will spend the remainder of the year in study and travel in Europe.

Dr. Wm. H. Taliaferro, professor of parasitology in the University of Chicago, arrived in San Juan, Porto Rico, on January 9, where he will be the guest of the University of Porto Rico, until his return to the United States about April 1. He will give a course in protozoology at the school of tropical medicine, San Juan, and will carry on immunological studies in malaria and other parasitic diseases.

Dr. Mary W. Calkins, professor of psychology in Wellesley College, during December gave two lectures at Bedford College, University of London, on "Conceptions of Meaning" and "The Nature and Types of Value." Dr. Calkins also read a paper before the British Psychological Society on "Self Psychology."

Professor Paul Walden, of the University of Rostock, gave a lecture at Harvard University, February 8, on "The Walden Inversion."

Dr. Dayton C. Miller, professor of physics in the Case School of Applied Science, addressed the Washington Academy of Sciences, February 16, on "Photographing and Analyzing Sound Waves."

According to *Popular Astronomy*, Professor Fred-

erick Slocum, director of the Van Vleck Observatory, has accepted an invitation this year to give the lectures which have become an annual feature for the people in Miami, Florida. The lectures are given under the auspices of the Southern Cross Observatory.

Dr. Bailey Willis, president of the Geological Society of America, lectured at Ohio State University on February 3 on the subject "Earthquakes." The lecture was under the joint auspices of the graduate school and the society of the Sigma Xi. In the afternoon Dr. Willis spoke before the seminar of the department of geology on "Some Aspects of the Earth's Dynamics."

Dr. John C. Hemmeter, professor of clinical medicine in the Johns Hopkins University, spoke at a meeting of the History of Ideas Club, Baltimore, on February 14 on "The Prerequisites to a Philosophy of History."

L. J. R. Holst, vice-president of Brock and Weymouth, Inc., Philadelphia, will lecture before the Franklin Institute on February 23 on "Topography from the Air."

Dr. Henry Laurens, professor of physiology in Tulane University, lectured before the chapters of Sigma Xi at the University of Missouri and the University of Kansas recently on "The Physiological Action of Radiant Energy."

Professor Lawrence J. Henderson, of the department of physiology at Harvard University, delivered an address before the Royal Canadian Institute, Toronto, January 28, on the subject "Physical Chemistry of the Blood."

The presidential address of Dr. Eugene L. Opie, before the Pathological Society of Philadelphia, was given on January 12, on "Experimental Production of Leukemia and Related Conditions."

Dr. Tobias Dantzig, professor of mathematics at the University of Maryland, is conducting a course in advanced mathematics for physicists and chemists at the U. S. Bureau of Standards during the present academic year.

Dr. Ross A. Gortner, head of the department of biochemistry at the University of Minnesota, recently delivered a series of four lectures under the auspices of the graduate school and the plant institute at the Ohio State University. The subjects follow: "Proteins in the Lyotropic Series," "Colloid Chemistry in Relation to Vital Phenomena," "Certain Electrokinetic Properties of Colloid Systems and Their Influence on Colloid Behavior," and "Chemical Problems Involved in Flour Strength."

Dr. Aleš Hrdlička, of the U. S. National Museum, Washington, D. C., lectured in Chicago on January 24, before the Chicago Chapter of the Sigma Xi, on "The Glacial Age and its Relation to Man"; on January 25 and 26 at the University of Chicago, on "Origin and Evolution of Man in the Light of the Latest Knowledge" and "The Lessons of Human Evolution"; on January 27 before the downtown science group on "Human Evolution—Past, Present and Future."

The Portland Academy of Medicine has recently been addressed by Dr. Corneille Heymans, University of Ghent, upon "Contributions to the Physiology and Pharmacology of the Vagus and Respiratory Centers," by Dr. T. Wingate Todd, Western Reserve University, concerning "The Bowels of the Profession," by Dr. Arthur L. Bloomfield, of Stanford University, upon his "Observations on the Composition of the Gastric Juice and the Mechanism of its Secretion," and by Dr. Moritz Weber, of the Hooper Foundation for Medical Research, on "Osteodystrophia Fibrosa: Clinical and Pathological Aspects, Etiology and Experimental Reproduction."

Dr. E. Schrödinger, who recently visited the United States, is to lecture in London on wave mechanics at the invitation of the Royal Institution. It has been arranged provisionally that the lectures shall be given on March 5, 7, 12 and 14.

On November 21, 1927, the memory of Reginald Somers Cocks, who for twenty years occupied the Richardson chair of botany at Tulane University, was honored when a bronze tablet was unveiled in the botany laboratory in the science building.

Dr. William C. L. Eglin, vice-president of the Philadelphia Electric Company and president of the Franklin Institute, died on February 7, aged fifty-eight years.

Dr. George Eric Simpson, of the department of physiological chemistry at the University of Pennsylvania, died on December 23 at the age of thirty-nine years.

Professor James Locke, at one time professor of chemistry at the Massachusetts Institute of Technology, died on February 11 at the age of fifty-eight years.

Mrs. Flora Wambaugh Patterson, formerly mycologist in charge of the pathological collections, U. S. Bureau of Plant Industry, died on February 5, aged eighty-one years. Mrs. Patterson retired from the bureau in 1923 after a period of twenty-seven years.

WILLIAM WALLACE PAYNE, of the observatory of the National Watch Company, Elgin, Ill., and founder of *Popular Astronomy*, died on January 29, aged ninety-one years.

DR. TRUMAN W. BROPHY, well-known oral surgeon of Chicago, died on February 4, in his eightieth year.

Nature announces the deaths of Sir Dyce Duckworth, formerly president of the Clinical Society of London from 1891 until 1893 and foreign correspondent of the Paris Academy of Medicine, on January 20, aged eighty-seven years; Surgeon Rear-Admiral Sir Percy Bassett-Smith, a past president of the Royal Society of Tropical Medicine and Hygiene, on December 29 at the age of sixty-six years, and Professor C. Diener, professor of paleontology in the University of Vienna, well known as the editor of the "Fossilium Catalogus," on January 6, aged sixty-five years.

THE Helminthological Society of Washington has passed the following minute: "The Helminthological Society learns with profound regret of the death of Professor Francesco Saverio Monticelli, a foreign corresponding member of this society since 1911. His election among the first group of twenty foreign parasitologists was a recognition of his distinguished achievements, now extending over forty years. He has joined the illustrious group of Blanchard, Ijima, Linstow, Looss, Luehe, Manson, Parona and Shipley, elected at the same time and now passed away. His work remains as the scientist's most fitting memorial and will long perpetuate his memory. This society laments his passing while at the same time it pays tribute to his worth and accomplishments. No better monument could a man have than that posterity remember his as a life well spent in the advancement of human knowledge."

THE nineteenth annual meeting of the Paleontological Society held at Cleveland, Ohio, from December 29 to 31, had the largest attendance and the largest election of new members in its history, making the total number of members in this affiliated branch of the Geological Society of America now 322. Twenty-one papers were delivered and the presidential address by Professor W. A. Parks on "Some Reflections on Paleontology" was given in joint session with the Geological Society of America. The following officers were elected for the year 1928: *President,* A. F. Foerste, Dayton, Ohio; *first vice-president,* M. G. Mehl, Columbia, Missouri; *second vice-president,* E. R. Cumings, Bloomington, Indiana; *third vice-president,* G. R. Wieland, New Haven, Conn.; *secretaary,* R. S. Bassler, Washington, D. C.; *treasurer,* Carl O. Dunbar, New Haven, Conn.; *editor,* Walter Granger, New York City.

THE 226th meeting of the northeastern section of the American Chemical Society was held on February 10, in Boston. The meeting was devoted to a discussion of the measurement of hydrogen ion concentration. Dr. William M. Clark, professor of physiological chemistry, the Johns Hopkins Medical School, read a paper on "Oxidation and Reduction," and gave an account of his studies of oxidation-reduction equilibrium in systems of dyes made by the potentiometer. Dr. W. A. Taylor, president of the LaMotte Chemical Products Company, Baltimore, Md., discussed the colorimetric method of "Hydrogen Ion Control in Industrial Processes," illustrating by experiments based on a color method devised by himself and his associates.

THE spring meeting of the American Society of Mechanical Engineers is to be held in Pittsburgh from May 14 to 17. The technical program has been completed and the manuscripts for the papers are expected to be in hand by March 1 so that they may be printed and distributed in advance of the meeting. Special sessions will be devoted to the iron and steel industry, the glass industry and the ceramics industry. In addition, the fuels, power, materials handling, machine shop practice, railroad and hydraulics divisions will sponsor sessions. There will be another group of sessions centering around the division of applied mechanics and the special research committee of mechanical springs.

ELECTRICAL engineers in New York and London planned to hold a joint meeting on February 16 through the use of two-way radio communication across the Atlantic. Programs of the American Institute of Electrical Engineers and the British Institute of Electrical Engineers were to be exchanged. The American Institute opened its meeting in New York on February 13.

THE invitation extended by the University of Virginia to the eastern section of the Seismological Society of America to hold their third annual meeting at that institution has been accepted by the executive committee on behalf of the section. The exact date has not been arranged.

THE Aristogenic Association, an organization which has for its purpose the extension of human life, and the development of leaders, with a view to improving the human race in the future, met for the first time on February 2, at the Union Club, New York, as guests of William S. Moore. Dr. C. Ward Crampton was chairman of the meeting. Among those who spoke were Professor James T. Shotwell and George Haven Putnam.

THE fifteenth International Geological Congress will be held in South Africa in 1929, and the date of the inaugural meeting in Pretoria is to be during the fortnight following July 29. The special subjects provisionally proposed for discussion are: (*a*) magmatic differentiation; (*b*) pre-Pleistocene glacial periods; and (*c*) the stratigraphy, paleontology, and world distribution of the Karroo system.

GENERAL UMBERTO NOBILE, designer, constructor and pilot of the airship *Norge*, in which the expedition of Captain Raoul Amundsen, Lincoln Ellsworth and General Nobile voyaged from Spitzbergen to Alaska over the North Pole in 1926, has left for Germany and Russia to make final arrangements with the governments of those countries for the Italian airship expedition with which he proposes to make scientific studies in the polar regions this summer. It is reported that with the exception of mechanics the crew will be composed entirely of scientific men, who will take the observations which are the object of the expedition.

ACCORDING to the Tokio correspondent of *Industrial and Engineering Chemistry,* more than five thousand engineers attended the first general meeting of the Kogakkai (the Engineering Society) on November 3 at the Tokyo Imperial University. The Kogakkai is made up of twelve technical societies, including those relating to mining, iron and steel, civil engineering, ordnance and explosives, shipbuilding, architecture, chemical industry, hygienic industry, electrical engineering, telegraphy and telephony, illuminating engineering and mechanical engineering. M. Okochi, head of the Institute of Physical and Chemical Research, gave an address on the fundamental industries. He selected the precision mechanical and the dye-stuff industries as types. Addresses were given on the recent advances in twelve important industries by the representatives of the related societies. Y. Oshima, president of the Society of Chemical Industry, Japan, told of the recent progress of chemical industry in Japan. On the two following days, sectional meetings of each society were held and about one hundred and sixty papers were read, fourteen being those of the Society of Chemical Industry. Six popular lectures and one radio broadcasting were given. Factories and laboratories were open for inspection by attending members. The International Engineering Congress will be held in Tokyo in October, 1929, under the auspices of the Kogakkai. The congress proposes to discuss various engineering problems for the promotion of international cooperation in the study of the engineering science in all its branches.

ACCORDING to press reports the offer by the General Education Board of the Rockefeller Foundation of $1,250,000 to aid the University of Minnesota in establishing a medical center on condition that the city of Minneapolis build a general hospital adjacent to the university was definitely rejected on January 5, at a joint meeting of the public welfare committee of the city council and the committee of twenty-three representing the board of regents, the public welfare board, and the Hennepin County Medical Society.

THE *Journal* of the American Medical Association states that an allotment of $2,000 has been made by the U. S. Treasury Department of the public health service for the preparation of an exhibit to be used at the International Exhibition at Seville, Spain, that will be held in October, 1928. The U. S. Government is participating in this exposition, and all of the government departments and bureaus will be represented. The exhibit of the public health service that is being prepared includes the subjects of smallpox vaccination, venereal diseases, tularemia, safe water and other miscellaneous items.

IN connection with the seventy-fifth annual meeting of the American Society of Civil Engineers it was announced that Charles E. Fowler, consulting engineer of New York, had given the society a trust fund for the granting of annual awards and prizes for engineering work, the awards to be bestowed in memory of the donor's late mother.

UNIVERSITY AND EDUCATIONAL NOTES

EIGHT fellowships worth from $4,000 to $9,000 a year will be established at the New York Orthopedic Dispensary and Hospital from the income of a gift of more than $1,000,000 from the residuary estate of Mrs. John Innes Kane. Mrs. Kane's will made bequests of approximately $4,000,000, including two $500,000 gifts to Columbia University, and directed the executors to distribute the residuary estate among such groups as she might select during her own lifetime.

A GIFT of $2,500,000 for the study of Oriental art has been made by the estate of the late Charles M. Hall, of Oberlin, who acquired $45,000,000 by a process of refining aluminum, which he devised. An institution in Peking will be endowed under the direction of Harvard University and the University of Peking.

FIRE destroyed the main building of Villanova College, Philadelphia, on January 28, and seriously damaged the monastery, with a loss estimated at $2,000,000. The chemical, physical and biological laboratories were a total loss.

It is announced that the Cleveland Clinic Foundation will receive the $400,000 estate of the late Frank Billings on the death of his widow.

St. Luke's Hospital and Washington University, St. Louis, are named in the will of Edward Mallinckrodt, chemical manufacturer, as preferred recipients of his estate, estimated at several millions, all of which he left to charity and education.

The board of regents of the University of Michigan has authorized the establishment at the university of a department of graduate medicine, and has asked Dr. James D. Bruce to undertake its organization.

Dr. Wiler Penfield, assistant professor of surgery at Columbia University and neurological surgeon at the Presbyterian Hospital, has been appointed professor of neurological surgery at McGill University.

Dr. John C. Forbes has been appointed clinical chemist for the three hospitals of the Medical College of Virginia. Dr. William B. Porter, professor of medicine, has instituted the new clinical chemistry laboratory with Dr. Sidney S. Negus, professor of chemistry, assisting in the details involved.

Dr. John A. McGeoch, of Washington University, has been appointed acting professor of psychology for the summer session of 1928 at the University of North Dakota.

Dr. A. K. Macbeth, reader in chemistry at the University of Durham, has been appointed to the Angas chair of chemistry in the University of Adelaide.

Professor Jacob, of the University of Toulouse, has been appointed professor of geology at the University of Paris.

Professor Fosse, of Lille, has been appointed to take the place of the late Professor Simon in the department of chemistry at the National Museum of Natural History at Paris.

DISCUSSION AND CORRESPONDENCE

APPLIED GEOPHYSICS

At the present time that subject which may be termed pure geophysics is making, in some directions, rapid progress owing to the practical applications of geophysics to underground exploration. A financial magnate exclaimed to the writer in two consecutive sentences, "It is impossible to know what is underground," and "Any one who could tell what was underground would be worth millions upon millions." I assured him that neither of these extreme views was true, and reminded him of X-rays, and of radio or wireless and of their successes in revealing the unseen. An electro-magnetic explanation left him cold and weary, for finance, like government, is often in the hands of men extraordinarily ignorant of the world in which they live. They are, however, usually experts in arithmetic and human nature!

The geophysical methods employed are divided naturally into two groups. In the northern mining regions magnetic, electrical and electromagnetic methods prevail, and these regions are often hilly, rocky, mountainous. In the southern or Gulf of Mexico region, which is often flat, the underground irregularities—such as the salt domes on the flanks or tops of which oil is often found—are sought for with seismic, gravitational, magnetic and recently with electrical methods.

For the guidance of those who are looking for further information the following references will be helpful. We are promised at an early date a translation into English of Ambronn's excellent treatise[1] on geophysics. This is to be written up to date by the author, and to include a full bibliography. Most of our readers will already have read, with pleasure and interest, the recent report[2] of Dr. Mason, president of Chicago University, which summarizes his investigations in field and laboratory during the last four years. There is also a large five-volume treatise, four parts of which have appeared, "Lehrbuch der Geophysik," by Professor B. Gutenberg (Gebrüder Borntraeger, Berlin).

The U. S. Bureau of Mines at Washington has recently issued a small bulletin, Technical Paper 420, which gives a brief and concise summary, primarily intended for mining men, of the principles and methods and apparatus available. It may be noted that in fig. 17 a battery appears to be giving an alternating current, owing to the omission from the diagram of a commutator which is, however, clearly mentioned in the text. Further criticism is not given here because the present writer and his colleague, Dr. D. A. Keys, are the authors.

As regards electrical and electromagnetic methods it may now be fairly claimed that these have stood well the preliminary tests, and that next they must face the fiery ordeal of achieving their actual purpose of discovering, in a useful manner, the conductors which are below the earth, and of discerning, as far as possible, their size, shape, depth and nature. This is a searching demand! Some ore bodies, such as zinc blende, do not conduct better than the rocks surrounding them, and thus evade detection. Underground water may conduct sufficiently well to simulate an ore body, thus deceiving an enthusiast who would not

[1] "Methoden der Angewandten Geophysik," Dr. Richard Ambronn, Göttingen. (Theodor Steinkopff, Dresden and Leipzig.)

[2] "Physical Exploration for Ores," Dr. Max Mason. (Physical Exploration Corp., 111 Broadway, N. Y.)

be fooled by surface water. A thin rich vein of worthless pyrites might prove an exciting discovery to a geophysicist, while the mine manager would view it with cold disdain.

The fact, however, remains beyond a doubt that good conductors can be located underground by several different electrical and electromagnetic methods, while they could not be detected by magnetic methods, and that suitable schemes may, and probably will, prove to be of great service alike to mining men and to geologists.

In games like golf and billiards, and in the more serious hazards of war by land or by sea, as much, or truly much more, depends on the man than upon the clubs, cue, weapons and ships—on the material things which he has at his disposal. For the expert and skilful man will insist on using to the utmost the very best, and on its maintenance at the very best. So too in geophysics a torsion balance, or a magnetometer, does not make a survey. These things are subsidiary to the skill and intelligence of the man who uses them, who understands their possibilities and limitations, who interprets their readings wisely. Since these things are true, the greatest country or state will always be that which develops most properly the real intelligence of its children and youth—always the sole greatest asset of any people.

To return to our main subject—geophysical prospectors sometimes claim too much, mine managers often expect too much. Disappointment leads them to join the scoffers. That is not the road to progress! There must be mutual confidence and cooperation between managers, engineers, geologists and physicists. So far none of them has proved infallible; all have to play the game of "blindman's buff" or "hoodman blind." All have to search with all the scientific aids possible. Diamond drills can not be used over the whole face of the earth. The day may come when the geologist will go before, and the geophysicists will follow after, next come the engineers with diamond drill, and behind them all the other men who, with joy and singing, will gather up most of the dollars.

A. S. EVE

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THE MULTIPLE ORIGIN OF TUMORS

PARTLY from clinical observation, partly from the intensive experimental work on neoplastic disease which has been carried on during the last quarter century, we now know of a considerable number of means by which tumors, particularly malignant tumors, may be artificially induced. These come under several distinct categories.

First, certain chemical irritants may induce them with some regularity. Coal tar applied to the skin over long periods of time, or injected into the tissues; indol; various arsenic compounds; and—a matter here of clinical observation—various aniline products—all have the effect of stimulating tissues to malignant hyperplasia, in some cases at least preceded by a period of benign overgrowth.

Second, physical irritation, best manifested by long applications of the X-ray, has the same effect. Third, embryonal tissues introduced into the adult animal may in certain circumstances develop into malignant tumor; best, perhaps, when to the effect of transplantation is added the element of chemical irritation, as by coal tar or indol. Fourth, malignant tumors may develop, as shown by Maud Slye, purely on the basis of hereditary factors. We may have malignant tumors induced by certain nematode parasites, acting in a manner as yet not fully determined. And finally, rather recently it has been shown by Blumenthal and his coworkers that in a certain proportion of human cancers *B. tumefaciens* may be isolated from the outskirts of the tumor. This, grown in pure culture and inoculated into plants and certain animals, may cause what to all appearances are tumors in them. In the case of the animal inoculations, sections show a fairly definite picture of malignant neoplastic growth, and on transfer to other animals of the same species the new growths behave like typical inoculable tumors. Of some significance in this connection is the fact that the organisms disappear in the later stages of the tumor, and in those resulting from transfer.

Instead of being in ignorance of the causative factor of neoplastic growth, we are really in a position of embarrassment at having too many possible causes, and the real problem in connection with the etiology of tumors would appear to lie in the reconciling of these to a single common factor. That there is such a common factor can not be questioned; the entire picture of neoplastic disease, both benign and malignant, is too definite to permit doubt on that score. As a matter of fact, the nature of that factor is shown in the histology of all tumors—it lies in their common possession of the property of more or less unrestricted growth—absolutely unrestricted in the case of the more malignant ones.

Viewed in this light, neoplastic proliferation must then be considered as a common type of reaction to a variety of causes—a reaction characterized by the more or less complete suppression of the usual normal balanced cellular activities with a corresponding accentuation of the single activity of cellular multiplication. In the sense of being a reaction to injury, tumor development would then be simply a special type of inflammatory phenomenon—one which is shown originally by the single cell or group of cells, as a result of which it loses its normal environmental

inhibitions and becomes capable of free and unlimited growth.

If this view is right, then neoplasms, and especially malignant neoplasms, must be regarded as tissues which in response to a number of different irritants react by showing a release from the normal growth gradients which ordinarily regulate body structure. The real problem of cancer then becomes a study of these gradients, and from the therapeutic standpoint their reestablishment when once lost or the prevention of their loss. The present line of study, largely devoted to the determination of the character of these irritants, will of course always be a matter of importance, but of secondary rather than primary grade.

Some of our therapeutic measures in the control of cancer are already directed to the former end. The use of radium and the X-ray, for instance, is essentially an effort to accomplish two things which tend toward a reestablishment of lost gradient—the inhibition through destruction—at best usually partial—of the unrestricted cell division, plus the stimulation of connective tissue growth to the point where this more nearly equals the proliferation rate of the tumor cells.

It would seem no longer correct to speculate as to the "cause of cancer." We would seem to have reached the point where it is necessary to recognize that there are a number of distinct causes, related only in the sense that they produce a common effect. Neoplasms then constitute an entity in the same sense that acute inflammation is an entity—a single type of reaction brought about by a variety of causes—and like that, an inflammatory process in that it is a reaction to injury.

To prove this experimentally aside from the finding of a still greater number of causative factors will be a difficult matter. One possible means would lie in the establishment of immunity, as to *B. tumefaciens*, and the demonstration that this immunity did not protect against other causes of cancer, as for instance, coal tar.

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THE CUTICULA OF NEMATODES

In an abstract published in the December, 1927, number of *The Journal of Parasitology*, on "The Cuticula of the Neamathelminthes," Justus F. Mueller states that he has found the cuticula of Gordius and Macracanthoyhynchus to be chemically homogeneous and that of Ascaris to be separated into two chemically distinct substances. All four substances are proteins of albuminoid character, none related to chitin. The three substances found in Ascaris and Gordius are fairly similar, while that of the acanthocephala is different. He states that he does not agree with me (*Camallanus americanus,* nov. spec. *Trans. Amer. Microsc. Soc.,* 1919, 38: 49–170) in calling the substance in Ascaris cornein, and states I was in error because of incorrectly translating Reichard.

Since the abstract does not call attention to the point I was attempting to make in my study, it would leave in the minds of those not familiar with the facts an incorrect idea. In the first place my error, for which I apologize, was due to my misconstruing the force of the subtitles of Reichard's paper; I thought at that time the heading "Cornein" was intended to refer to the cuticula of worms and my error was not one of translation. The whole purpose of my contribution was to show that the cuticula of nematodes was not chitin but was a protein of albuminoid nature. In this I am glad to see that Mueller agrees. Cornein is also an albuminoid. I had been taught and had read in many commonly used texts, in the article written on nematoda for the Encyclopedia Britannica by Shipley and Beddard and in articles on nematodes by such men as Ransom, Hall and Ward that the cuticula of nematodes was chitinous. Indeed some zoologists, as proof of the supposed relation of worms and arthropods, stated that both had chitinous covering. As pointed out in my paper, Leuckart was undoubtedly responsible for the misconception, although he knew that the two coverings were fundamentally different. In spite of the fact that men as far back as Lassaigne (1843) pointed out the difference in the cuticula of Ascaris and the chitin described by Odier, authors still referred to the covering of nematodes as chitinous. My study was undertaken to show conclusively the differences in the structures. I concluded that the cuticula of nematodes was composed of a protein of the albuminoid type, closely related to connective and supportive tissue and unrelated to chitin. In this I carried on further the work of Reichard and agreed with him in his work, but incorrectly stated that he called the substance cornein.

Mueller states that he has for the first time correctly analyzed this material, basing his statement on the fact that he analyzed the two parts separately, unless he means to imply that the actual analysis of all other authors was erroneous. The former statement depends on the point of view. By his own statement the two parts form the cuticula; therefore to analyze them together would certainly constitute a true analysis of the cuticula, just as, in analyzing the liver or spleen, one does not separate them into their many components. Reichard called attention to certain physical and chemical differences in two layers of Ascaris and I described four layers for Camallanus. Others have subdivided the cuticula of nematodes into

different layers, and in partly dried material one is often able to strip off several layers. Mueller's statement that the cuticular layers of Ascaris are "fairly similar" leads me to hope that his analysis may be regarded as in a general way confirming my own.

It is interesting to note that Ward states in his chapter on Parasitic Worms (Ward and Whipple, "Fresh Water Biology") in discussing the cuticula of nematodes that "it has been correctly designated as cornein by Reichard." Since no reference to my incorrect statement is made in this text book it may be inferred that Ward also was misled by the subtitles.

THOMAS B. MAGATH

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AN UNUSUAL ATMOSPHERIC PHENOMENON

ON the morning of December 14 a rather unusual atmospheric phenomenon, the so-called circumzenithal arc, was observed at Brunswick, Me. It had the form of a bright rainbow-like arc about 90 degrees in extent with its center of curvature approximately at the zenith. The colors were much more clearly defined than in the ordinary rainbow, the red being at the outer edge of the arc and the violet at the inner. The arc extended in azimuth roughly from west to south. When the phenomenon first appeared the sun was at an altitude of some 20 degrees, and the edge of the arc at about 70 degrees. The arc remained visible for about half an hour. The weather at the time was clearing, and low lying fog clouds moving from north to south partially obscured the sun although blue sky was visible near the zenith. The surface temperature was slightly above freezing.

The phenomenon just described while rare is not unknown. It may be explained by the refraction of the sun's rays in passing through columnar snow crystals with tabular caps, the crystals acting as right prisms. A detailed explanation of the circumzenithal arc is given by Humphreys in "Physics of the Air," p. 511. The striking feature of this particular occurrence of it was its duration. As generally observed it has lasted only about five minutes, while in this instance it was distinctly visible for a full half hour.

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PSYCHO-ENDOCRINOLOGY

NEW words are sometimes as important events in history of science as new discoveries. For the word means the crystallization of a new concept. And the crystallization of a new concept means the attainment of one of the ideals of science: the correlation of the relationships of hitherto unrelated observations and findings. Such new concepts are valuable not only for classification of the activities of the worker in science in the past, but also for orientation towards the problems and methods of the future.

Accumulating information during the past fifty years has pointed to an importance of the endocrine glands for the problems of the science of psychology. Whether that science be looked upon as the study and control of consciousness or whether it be looked upon as the study and control of the behavior of an organism as a whole reacting to an environment makes no difference. From either viewpoint, evidence has accumulated that the endocrine glands, modifying conditions in the organism in general and in the nervous system in particular, are of the utmost significance for the data of psychology.

It is time I think an attempt was made to collect under the rubric of a single name the results of various individual investigations in the fields of psychology, biochemistry and medicine, where they will be collectively available to the research worker. I propose the word "psycho-endocrinology" as the name for that branch of science which deals with the relation of the endocrine glands to mental activities and processes, as well as to behavior, including the individual characteristics in health and disease, summarized in the term personality.

LOUIS BERMAN

QUOTATIONS

STATE ACADEMIES OF SCIENCE

THE American Association for the Advancement of Science has now in affiliation with it the academies of science of twenty-two states. As an organization this association and its affiliated organizations are not much given to talking of themselves. The report of the activities and progress of the state academies as told in an address of the president of the New Hampshire Academy and published in SCIENCE would indicate that they have a position of importance in creating an interest in scientific achievements and disseminating valuable scientific information. The name of the association might suggest an exclusive gathering of college professors and scientists. While it has in its own membership and that of the affiliated organizations men of learning and attainments in scientific research at the same time it has members who may never have spent an hour in a scientific laboratory, whose part in the organization is that of individuals of the ever-increasing number in this country who are interested in science and who find in one or more of its branches, as the report says, an avocation or a hobby distinct from their ordinary life routine.

The first of the associated organizations dates back to 1853, when the New Orleans Academy of Science, now known as the Louisiana Academy, was formed. It was not until the period from 1866 to 1870 that the number of academies had reached four. This number had increased to twenty by 1924, when the Alabama Academy was formed. The youngest of the affiliated organizations is the South Carolina Academy, which became a member of the association in October of this year. The credit of being the pioneer in this field should perhaps belong to the Maryland Academy of Science, originally formed in 1797.

Besides the associated organizations in the eastern and southern states there are a Pacific division and a southwestern division of the American Association. It is an evidence of the national interest in scientific studies that there are academies of science in all the Pacific Coast states, with which are affiliated other scientific organizations in the Rocky Mountain states, British Columbia, Alaska and the Hawaiian and Philippine Islands, and that in the southwest there is an affiliation of similar organizations covering the states of Arizona, New Mexico, Colorado, the two bordering Mexican states of Sonora and Chihuahua and the state of Texas west of the Pecos.

The number of members enrolled in the academies varies widely; the New Orleans Academy has about fifty members, while the Maryland and Indiana academies have about 800. There is apparently no hard and fast rule regarding the qualifications for members. The New Orleans society is limited to research workers, which may account for its small membership. In fourteen of the academies any one "interested in science," "interested in the progress of science" or "interested in scientific work" may become an active member. Georgia requires five years of recognized scientific work or some notable contribution to science. New Hampshire asks for proficiency "in some branch of science," North Carolina wants active interest in the promotion of science and Maryland stands out in requiring, besides an interest in science, "a desire for self-improvement and a desire to help others." Most of the state academies apparently interpret the term science to cover "most of the field of classified knowledge and orderly thinking."

The work which the academies have undertaken or accomplished varied largely with the demands which the different states have made upon the organizations. In a general way all have endeavored to arouse interest in scientific matters, publish papers primarily for non-scientific readers, present non-technical lectures, encourage scientific research among graduate students and foster higher standards of scientific work. Some of the academies have sought to make collections of scientific literature that might not otherwise be accessible to students. The New Hampshire Academy financed from its own funds the publication of Professor J. W. Goldthwait's valuable "Handbook of the Geology of New Hampshire." The Maryland Academy has its own building, which it opens to the use of the scientist. Eight of the state academies have libraries of their own; the library of Kansas contains 4,000 volumes on research, Indiana has 6,000 volumes and Wisconsin offers the student several thousand books on modern attainments besides 700 exchanges of publications from all parts of the world. The inference which the president of the New Hampshire Academy draws from his study of scientific advance in the last few years is that "the state academies have been and are very valuable, not only to the members but also to the progress of science and education in general and consequently to the public at large."—*New York Sun.*

REPORTS

RESOLUTIONS ADOPTED BY THE INTERNATIONAL GEODETIC AND GEOPHYSICAL UNION[1]

I. In view of the decision unanimously adopted, June 29, 1926, by the International Research Council at its general meeting at Brussels, according to which the contribution to be paid by each of the adhering countries is to be henceforth calculated in gold francs, the sum originally adopted as the unit of contribution, in each union, to be at the same time reduced in a proportion included between a third and a fifth of the present figure;

Considering that, for the International Geodetic and Geophysical Union, the unit of contribution has been until that time fixed at 2,600 French paper francs, which, in the beginning of 1919, were equivalent to about 1,800 gold francs:

The General Assembly unanimously proposes to replace provisionally, beginning with 1928, this amount by a round sum of 900 gold francs and invites its bureau to bring this resolution to the attention of the International Research Council and of the national committees of the various associated countries.

II. In view of the desire expressed by the American National Committee of Geodesy and Geophysics to have, in the future, the International Geodetic and Geophysical Union and the International Astronomical Union hold their meetings the same year at an interval of only a few weeks and in cities not too

[1] Resolutions adopted by the third general assembly of the International Geodetic and Geophysical Union held at Prague, Czecho-Slovakia, September 3 to 10, 1927. Translated from the French by H. D. Harridan, Department of Terrestrial Magnetism of the Carnegie Institution of Washington.

distant from each other so as to facilitate attendance at these meetings by scientific men interested in the work of both unions;

The General Assembly of the International Geodetic and Geophysical Union invites its bureau to enter into correspondence with the Bureau of the International Astronomical Union for the purpose of carrying out, if possible, the proposal in question.

III. The assembly reelects unanimously, as president of the union, M. Charles Lallemand, whose term of office, according to article 6 of the statutes, had expired.

IV. On the proposal of the Section of Geodesy:

The General Assembly recommends that the governments possessing a submarine fleet undertake, as soon as possible, gravity determinations on board submarines by the new method of Vening-Meinesz—such determinations being of the greatest interest to geodesy.

V. On the proposals of the Section of Seismology:

(1) The General Assembly recommends that seismological installations be made in the following regions:

(a) In the northern part of Spain and in the Balearic Islands to complete the réseau of Spanish stations.

(b) In New Caledonia and Tahiti to complete the réseau of the French colonies.

(2) At the request of the American Committee of Geodesy and Geophysics, the General Assembly recommends that, wherever it may be possible, observations and studies be made, in common, on the ocean deeps and on their relations with the bottom-relief, with gravity anomalies, and with depth of seismic centers.

VI. On the proposals of the Section of Meteorology:

(1) The General Assembly notes with satisfaction that the published tables of observations made in the upper atmosphere contain results from tropical stations and from stations in the Southern Hemisphere, in particular wind and temperature soundings at Hongkong and wind soundings at Colombo and Dewa in the Island of Ceylon, at seven stations in Brazil, at Pretoria in South Africa, at Melbourne in Australia, and at Apia in the South Pacific; it recommends that this work be continued and developed through international cooperation.

(2) The General Assembly further recommends that, as far as possible, copies of the minutes of the section be made available to meteorologists desirous of carrying out investigations and that a list of persons to whom these minutes should be sent be drawn up by the national committees.

VII. On the proposals of the Section of Oceanography:

(1) The General Assembly approves the creation of a permanent mixed commission organized with the cooperation of the sections of seismology and volcanology for the purpose of collecting all the documents of use for the study of the phenomenon of bores.

(2) The General Assembly approves the creation of a permanent mixed commission organized with the cooperation of the Section of Meteorology for the purpose of studying the influence of polar ice on climates, especially in the Southern Hemisphere.

VIII. On the proposals of the Section of Volcanology:

(1) The General Assembly, considering that studies of the thermal gradient of the earth are not only of interest to pure science, but also to industrial applications, recommends that the Italian government kindly intrust to its National Research Council the mission of undertaking such investigations on the volcanoes of Italy and especially on Vesuvius.

(2) In view of the importance to science which is offered by the state of the extinct volcanoes and the lavas of the Aegean Sea, the General Assembly recommends that the petrological laboratory of the University of Athens continue its systematic studies of this subject.

(3) At the request of Professor Ktenas, of the Academy of Athens, it recommends that the new volcano in the Kamenis Islands of the Santorin Archipelago, the eruption of which began August 11, 1925, keep the name of the great geologist Fouqué.

(4) In view of the international interest presented by the measurement of the speed of propagation of longitudinal and transversal waves in solid and fluid magmas near the point of fusion, it recommends that such measurements be undertaken by countries having active volcanoes in their territory and in that of their colonies.

CH. LALLEMAND,
President of the Geodetic and Geophysical Union

H. G. LYONS,
Secretary-General

SCIENTIFIC APPARATUS AND LABORATORY METHODS

INFILTRATING PIG EMBRYOS WITH PARAFFIN

AFTER much experimentation in our laboratories with various methods for infiltrating pig embryos with paraffin, we have found the method described below as the most satisfactory and one never failing to give the desired results.

When the embryos have been thoroughly dehydrated they are cleared in oil of cedar or origanum. They should remain in the clearer for one hour after sinking to the bottom of the container to insure thorough clearing. The embryos are then removed and washed in xylol for ten minutes to prepare them for subsequent treatment by removing the oil which adheres. Next, the embryos are placed in a solution of paraffin-xylol. The most satisfactory solution is prepared by dissolving at ordinary room temperature 24 grams of paraffin in 100 cc of xylol. It is well to have this solution prepared a few days in advance to prevent delay. The amount of solution used should be three or four times the bulk of the embryos. The embryos are left in this solution from two to six days depending on their size. (See Schema at end.) After removing the embryos dip them once or twice in xylol, then place them in melted paraffin and put in oven. The melting-point of the paraffin should not exceed 52 degrees Centigrade nor should the temperature of the oven. At the end of fifteen minutes the paraffin is poured off and fresh-melted paraffin put on. This procedure should be repeated at least three times. At the end of forty-five minutes it is wise to smell of the embryos to make certain that all the xylol has been removed. If the slightest trace of xylol is detected change the paraffin a fourth time. All the xylol must be removed, otherwise the imbedding paraffin will crystallize and great difficulty will be experienced in sectioning.

It is a well-known fact that heat is detrimental to all tissue, even adult tissue, not to mention its effect upon embryonic. In infiltrating tissue it is most essential to submit it to heat for the shortest time possible. Heat shrinks, hardens and distorts tissue, thereby rendering it worthless. We have found pig embryos to shrink from 1/16 to 1/4 their natural size when submitted to heat for as short a period as two hours at 52 degrees Centigrade. The tissue shrinks and hardens so rapidly that it is impossible for the paraffin to penetrate and as a consequence imperfect infiltration results, particularly in those parts of the embryo where shrinkage is the greatest. In sectioning, the parts not infiltrated crumble and fall out. This is invariably the case with the liver of the embryo. The liver is very compact, the interstices minute and the shrinkage great. By using a paraffin-xylol solution a sufficient amount of paraffin penetrates the tissues so that when the embryo is placed in the melted paraffin and put in the oven, the paraffin, which has already penetrated the embryo from the paraffin-xylol solution, melts and by capillary action rapidly draws in the fresh paraffin and forces the xylol out in less than one hour. The maximum shrinkage in pig embryos takes place after the first ninety minutes in the oven.

An objection which might be raised against the use of paraffin-xylol is that tissue left in xylol for many hours becomes brittle and brittleness is as ruinous to tissue as heat. This objection is true when xylol is used as the clearer—but when cedar oil or oil of origanum is used as the clearer the embryos may remain in paraffin-xylol for a week without becoming brittle.

Below is a Schema which shows the relative amount of time necessary for embryos of various sizes to remain in the paraffin-xylol solution in order that they may be thoroughly infiltrated after being in the oven from 45 to not more than 60 minutes.

Schema

Size of Embryo	Length of Time Embryo is in Solution of Paraffin-Xylol
7 mm. to 10 mm.	48 hours
11 mm. to 15 mm.	54 hours
16 mm. to 20 mm.	65 hours
21 mm. to 24 mm.	77 hours
25 mm. to 29 mm.	88 hours
30 mm. to 34 mm.	95 hours
35 mm. to 39 mm.	104 hours
40 mm. to 45 mm.	110 hours
46 mm. to 50 mm.	119 hours

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SPECIAL ARTICLES

THE ANATOMY OF THE CORIUM

It was pointed out by Dupuytren[1] in 1836 that a round, pointed awl thrust into the human skin produced not round openings but linear slits. This property of the corium was very fully studied by K. Langer in 1861.[2] From the work of Langer it is evident that in the human there are very definite directions in which these cleavages take place and that these directions are constant for an anatomical part. Nussbaum[3] and Burkard[4] have studied these cleavage lines in the human foetus and have shown the changes that take place during development.

[1] Quoted by K. Langer.

[2] Langer, K. "Über die Spaltbarkeit der Cutis." *Sitz. berichte d. K. akad. d. Wissenschaften S.* 19 Bd. 44, 1862.

[3] Nussbaum, Ilse. "Über die Spaltungsrichtung Menschlicher Embryonen." Inaug-Diss. Berlin, 1923.

[4] Burkard, Otto. "Über die Hautspaltbarkeit Menschlicher Embryonen." *Arch. f. Anat. u. Physiol. Anat. Abt.* S. 13, 1903.

The correlation between these cleavage lines in the human and the direction of the supporting fibers in the tela subcutanea was reported by me before the American Association of Anatomists in Nashville in 1927.[5] On the basis of earlier experimental work (Batson and Zinninger[6]) which shows that tension physiologically applied produces connective tissue fibers in the direction of the pull, it was postulated that the manner of distribution of the retinacula cutis and the anatomy of the more extensive deposits of fibrous tissue, now going under the name of various fascias, together with the connective tissue fibers of the corium responsible for the cleavages (earlier studied by von Langer) were the result of the tension placed upon these structures by their own weight, and by the weight of associated structures (*i.e.*, capital hair, mammae and genitalia). Naturally both the circumferential and linear growth of the parts covered by the skin must not be overlooked as a source of tension. This growth factor is significant in studying the direction of fibers and cleavages in the developing organism. Skin muscles likewise play their part.

It has been found that the "splitability" of the corium may be studied after it has been detached from the underlying structures, and this has made possible the gathering of much additional information on the human and opened up the possibility of the study of the detached animal skin. These split-like cleavages have been produced in the corium of the following: the dog-fish, the frog, the dog, the pig and the chimpanzee. It would appear that if the arrangement of the corium fibers were due to functional factors, that the direction of these cleavages should have a direct relationship to the posture of the animal. Further with the knowledge of the habits of any form it should be possible to foretell the directions of the principal cleavages in that comparative form. Parenthetically it might be added that these cleavages in addition to being present in the skin and mucous membranes may be demonstrated in the serous membranes of the body, vessels, periosteum, dura mater, cartilages and in the capsules of parenchymatous organs as well. The specific study of these ramifications of the problem are now in progress in this laboratory. The lines of cleavage in the corium of the dog which have been more specifically studied do not resemble the human but correspond to what would be supposed, considering the postural habit of the animal. This correlation strengthens the previously proposed idea that the anatomy of the corium was developed through function. The wide variety of animals showing cleavage lines in the corium can leave no doubt that this property of the corium is common to all animals.

Leather, that is tanned corium, shows this same property. The cleavages may be at any angle to the furrows of the animal's skin or to the "grain" of the leather. Laboratory tests show that leather is stronger in the direction parallel to the direction of the cleavage. This idea negates a common one that an area of leather has its strength uniform in all directions. This finding applied to the manufacture of leather articles should secure the maximum of strength and a greater uniformity of product.

Studies of the microscopic anatomy of the corium responsible for these splits occurring in a longitudinal direction are now under way. Three possibilities suggest themselves as explanations; 1. More connective tissue fibers in the direction of tension. 2. Greater length of connective tissue fibers in the direction of tension and 3. Difference in character of the fibers running in the direction of tension. The first notion, *i.e.*, that the cleavages are due to a greater number of connective tissue fibers lying in that direction seems the most probable.

O. V. Batson

University of Cincinnati

[5] Batson, O. V. "The Anatomy of the Tela subcutanea." *Anatomical Record*, p. 4, Vol. 35. 1927.

[6] Batson, O. V., and Zinninger, M. M. "The Experimental Production of Annular Ligaments, as an Example of the Influence of Function upon the Differentiation of Connective Tissue." *Bull. Johns Hopkins Hospital*, p. 124, Vol. XXXVIII, 1926.

THE DIALYSIS OF PITUITARY EXTRACTS

The physiologically active material contained in extracts of the posterior lobe of the pituitary gland diffuses readily through the ordinary dialyzing membranes.[1] The rate of dialysis suggests that the active principle (or principles) is considerably more complex than adrenalin, but somewhat simpler than insulin or the parathyroid hormone.

In a preliminary report[2] I compared the relative rate of dialysis of pituitrin with that of a compound of known molecular weight (adrenalin) and suggested 600 as the approximate molecular magnitude of the pituitary principle. This early work appeared deficient because it relied only upon the pressor assay method but the actual laboratory results have now been verified and are presented below.

In the meantime an excellent report[3] on the dialysis of pituitary extracts has been published by Smith and

[1] *J. Physiol. 25*, 87 (1899); *Am. J. Pharm. 86*, 291 (1914); *Biochem. J. 9*, 307 (1915); *Brit. Med. J.* I, 502 (1900); *Proc. Roy. Soc.* (London), B. 77, 571 (1906); *J. Pharmacol. 15*, 81 (1920).

[2] Washington Meeting, Amer. Chem. Soc., April, 1924.

[3] *J. Pharmacol. 24*, 391 (1924).

McClosky, of the U. S. Hygienic Laboratory, and these workers have applied both the pressor and oxytocic assay methods. They found that the two types of activity show identical diffusion rates, thus suggesting the presence of a single hormone.

Smith and McClosky have so adequately described the technique of preparing and using collodion membranes for this dialysis work that further experimental details are unnecessary. The only variation in the present work consisted in the use of a volume of solvent outside of the membrane exactly equal to that contained inside and provision for uniform stirring. The collodion membrane, cast in the form of a large-size test-tube, was suspended in a glass cylinder of such diameter that the liquid level inside was exactly equal to that outside.

In the following experiments the active material was dissolved in one fourth per cent. aqueous acetic acid and dialyzed against acetic acid of the same strength. At the beginning of the experiment the outside concentration was, of course, 0 per cent. The maximum per cent. attainable in the outside chamber (50 per cent.), obviously was not attained since the experiment was not run to final equilibrium. Samples were withdrawn for assay usually at 15, 30, 60 and 120 minute intervals and subjected to assay. The experiments were conducted at a temperature of 25° C.

EXPERIMENT I

Dialysis of Pituitrin

Assay by Pressor Method

Time	Concentration Inside	Concentration Outside
0 min.	100 per cent.	0 per cent.
30 "	—	12 per cent.
60 "	—	20 per cent.
180 "	50–60 per cent.	40 per cent.

In all cases the potency of the pituitary solutions is expressed in terms of the U. S. P. standard. The potency of adrenalin is expressed in terms of 1:1000 adrenalin solution.

In order to rule out the error due to variations in permeability of the collodion membranes, the adrenalin was dialyzed through the same membrane used in the first experiment and with the following results:

EXPERIMENT II

Adrenalin Dialysis

Time	Concentration Inside	Concentration Outside
0 min.	100 per cent.	0 per cent.
15 "	—	13 per cent.
30 "	—	22 per cent.
60 "	60 per cent.	35 per cent.

From the above figures it is apparent that adrenalin dialyzes twice as rapidly as does the pressor principle of pituitary extracts and if the laws of diffusion of gases are applicable to the dialysis of these complex substances through collodion membranes one might conclude provisionally that the pituitary principle is approximately four times as complex, from the standpoint of molecular magnitude, as is adrenalin.

In the following two experiments a different membrane was used and also a more concentrated pituitary solution. The samples were assayed by both the pressor and oxytocic methods.

EXPERIMENT III

Dialysis of the Pressor Activity

Time	Concentration Inside	Concentration Outside
0 min.	400 per cent.	0 per cent.
15 "	—	40 per cent.
30 "	—	80 per cent.
60 "	—	100 per cent.
120 "	250 per cent.	160 per cent.

EXPERIMENT IV

Dialysis of the Oxytocic Activity

Time	Concentration Inside	Concentration Outside
0 min.	480 per cent.	0 per cent.
15 "	—	70 per cent.
30 "	—	100 per cent.
60 "	—	120 per cent.
120 "	325 per cent.	175 per cent.

Although the above results are not as uniform as the physical chemist might expect in a quantitative experiment, it must be remembered that the results are all based upon physiological assays on animals and are actually within the accuracy of the experimental methods. For this physiological work I am greatly indebted to Messrs. L. W. Rowe and E. P. Bugbee.

The results of experiments III and IV verify the claim that the pressor and oxytocic activities dialyze at practically uniform rates and agree with the assumption that a single active principle is responsible for both types of physiological activity. Indirect evidence of this kind, however, is not final and we must still consider the possibility of two active principles that are similar not merely in chemical constitution but also in molecular magnitude.

The molecular weight of the active principle (or principles) may be considered as approximately 600 until direct measurements are available.

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ARTIFICIAL RADIUM RAYS

ARTIFICIAL rays of radium, in quantities that could only be obtained from a ton of this valuable element, worth 56 billion dollars at present prices, will soon be produced in the laboratory, according to a statement made by Dr. William D. Coolidge, of the General Electric Company, inventor of the X-ray tube now in general use. He revealed for the first time details of a new form of his cathode ray tube, and which, by a method of cascading, he has already operated at 900,000 volts, three times as many as previously achieved.

Radium gives off three kinds of rays: alpha rays, or rapidly-moving atoms of helium; beta rays, or speeding electrons—the "atoms" of electricity, and gamma rays, similar to X-rays. It has not been possible to successfully imitate radium radiation because sufficient electrical power could not be put into the generating apparatus.

Dr. Coolidge's latest invention will make it possible to increase the voltages applicable to X-ray tubes generating gamma rays, and it will also enhance the power of the cathode-ray tubes and speed up the electrons which correspond to beta rays. In fact, it may be possible in time to surpass the power of radium and provide a new tool for the scientist who now uses radium medically and industrially with telling effect.

Speaking before the American Institute of Electrical Engineers, which conferred upon him the Edison medal, Dr. Coolidge indicated what the apparatus can do.

"This opens a vista of alluring scientific possibilities. It has tantalized us for years to think that we couldn't produce in the laboratory just as high speed electrons as the highest velocity beta rays of radium and just as penetrating radiations as the shortest wave-length gamma rays from radium. According to Sir Ernest Rutherford, we need only a little more than twice the voltage which we have already employed to produce X-rays as penetrating as the most penetrating gamma rays from radium and three million volts to produce as high speed beta-ray.

"The intensity factor would be tremendously in our favor, as with twelve milliamperes of current we would have as many high speed electrons coming from the tube as from a ton of radium. Another factor in our favor would be the control which we would have of the output. This would be quite different from our position with respect to radium, in which case no physical or chemical agency at our command in any way affects either the quality or the quantity of the output.

"What shall we do with the high speed particles obtainable from tubes operating at a potential difference of millions of volts? The lure, of course, lies in the fact that we can't answer the question, beyond saying that we shall experiment with them. They should eventually help us to further knowledge of the atomic nucleus and to further knowledge of radiation laws. It is furthermore not unlikely that therapeutic, chemical bactericidal or other practical uses will develop."

Dr. Coolidge's original cathode ray is an evacuated bulb, with two long extensions. Through one end comes the cathode, which consisted of a small electric lamp filament of tungsten. Such a filament, when lighted, gives off electrons, moving very slowly. Through the other projection from the bulb extends a long copper tube, the anode. When the filament is lighted, a copious stream of electrons is emitted. Then a high voltage, say 250,000, is applied to the tube. This powerful current speeds up the electrons so that they travel through the copper tube and out to the open air through a thin nickel "window." A "cold cathode effect" prevents the use of more than about 250,000 volts in one tube.

The method now used by Dr. Coolidge to speed up the electrons still more is the very ingenious one of placing several tubes in tandem. The electrons, or cathode rays, in the first tube are furnished by the glowing filament. The end of the first tube takes the place of the cathode of the next, and the electrons from the first tube, already rapidly moving, are still further speeded up by the application of 250,000 volts in the second tube. The speeding stream is fed into a third tube, from which the rays emerge with a speed equivalent to that of the total voltage of the three tubes. With three tubes, Dr. Coolidge has obtained the effect of 900,000 volts, and much more can be used without serious difficulty.

When cathode rays strike a solid metal "target" X-rays are given off. Thus, a similar arrangement could be used to produce the most powerful source of X-rays ever devised. To accomplish this the last bulb of the series would contain such a target, from which the X-rays would be emitted.

BIOLOGICAL EFFECTS OF ELECTRIC WAVES

AN attack on cancer is being made by high frequency electricity, close in wave-length to the short waves that have recently been found so effective in radio communication.

The researches conducted by the U. S. Public Health Service under the direction of Dr. J. W. Schereschewsky, with his laboratory at the Harvard Medical School, have been in progress at intervals during the last five years and have now been informally reported to a congressional committee in connection with a request of an appropriation of $5,000 to provide assistants and material for the work.

Experiments so far have been confined to mice and chickens. Much progress must be made before there can be any possibilities of applying the results to human beings. Mice with tumors artificially acquired in the

laboratory were improved by being subjected to doses of oscillating electricity produced by vacuum tubes similar to those used in radio sets.

The frequencies used by Dr. Schereschewsky in his experiments ranged from 8,300 to 135,000 kilocycles per second, a range that expressed in the more familiar language of radio corresponds to wave-lengths below about 40 meters. The most effective frequencies were found to be at about the middle of the extremes used, and more deaths of the mice occurred at the high and low ends of the frequency range. Some of the mice treated suffered a shriveling of the ears and tail due to the current to which they were subjected, but many were perfectly normal after the treatment that had a beneficial effect on the cancers.

The dosage of electricity used by Dr. Schereschewsky were much more than any one could possibly receive from radio broadcasting, and public health officials discounted in advance any ideas or suggestions that the speed of radio would by this means aid in the treatment of cancer. They also emphasized the fact that the method was still in its early experimental stage upon animals only, and that treatment of human beings is still far in the future.

The investigations are being supported by the U. S. Public Health Service, with laboratory space furnished by the Harvard Medical School. They are now being pushed on account of the promising results and the unique methods that have been developed.

MEASUREMENTS OF THE SUN'S DISTANCE

A DEFINITE check on the distance of the earth from the sun is being made by University of California astronomers through observations of stars that will form a background for the planetoid Eros when it makes its remarkably close approach of 16,200,000 miles to the earth in 1931.

Many of the observations already have been completed by Dr. R. H. Tucker from the Lick Observatory on Mount Hamilton.

The positions of 821 stars were accurately determined in the series of observations thus far completed, according to Dr. Tucker. In the second series of observations, of 102 stars, about 2,100 checks were made during the course of 77 nights of work during the best observing season at Lick Observatory in 30 years.

The positions of the fixed stars, it is explained, appearing in the same portion of the sky as will the planetoid Eros during the coming approach, although at an infinitely greater distance away, will aid in the determination of the distance of Eros from the earth, both in terms of miles and in terms of a common astronomical unit, the mean diameter of the ellipse which the earth describes about the sun once each year.

By determining the exact distance of Eros in terms of both miles and of the unit of distance set by the earth's orbit about the sun, it will be possible also to compute the latter unit of distance in miles more accurately than ever before.

Eros' approach in 1931, astronomers state, will be its first close approach since its discovery in 1898. It is a small body, some fifteen or twenty miles in diameter, o of the host of such bodies known as the asteroids, but departing from the path followed by most of the group sufficiently to bring it in close proximity to the earth once in about 36 years.

SNAILS AND FRESH WATER FISH

THE humble pond snail has been indicted as one of the criminals whose activities have interfered with the peace and welfare and the family life of our fresh-water fishes. Ichthyologists generally have been unable to explain why so few of the hundreds of thousands of eggs laid by each female among the fresh-water fish ever reach maturity.

In a life-history study of the long-eared sunfish, carried on at the Indiana University Biological Station at Winona Lake, Indiana, observations were made each day of the troubles of a vigilant male sunfish trying to guard his nest with its precious eggs.

This sunfish had very little trouble with the larger fish. They had seemed to learn their lesson of the purpose and use of the fin spines and remained at a respectful distance. Minnows lingered in a persistent swarm and darted into the nest every time the warrior's attention was diverted, but their activities were more of a nuisance than a vital menace.

The greatest difficulty the harassed father sunfish had was the insidious advance of the tank corps of snails. The sunfish could not kill the snails because of their protective shells, but had to pick them up and carry them away from the nest one at a time. By the time he was transporting one half a dozen others would crawl in among the eggs and eat their fill.

Several thousand eggs and a few snails were put in a bucket over night. In the morning all the eggs had disappeared, and an examination of the snails' stomachs did not leave even a scientific doubt as to where they had gone.

THE DEATH RATE OF 1927

THE healthiest year in history was 1927. Only 8.4 deaths for every 1,000 persons is the record for a group of insured wage-workers that numbers one seventh of the total population of the United States and Canada.

If the death rate of 1926 had prevailed, 8,808 persons among the insured group now living would have died, and if the rest of the population improved its health as much, some 50,000 lives were saved. If the death rate of sixteen years ago, 1911, had not been reduced 33 per cent. to the present figure, last year's death list would have numbered 72,570 more among the insured group.

These facts are shown by the statistics of the Metropolitan Life Insurance Company reporting the mortality of its industrial policyholders which had been found to reflect the trends of the whole population.

The outstanding health fact of 1927 was the big drop in the tuberculosis mortality, the rate of 93.5 per 100,000 representing a decrease of 4.8 per cent. from the previous minimum of deaths from the great white plague. Recent surveys have shown that this reduction applies to all parts of the country, rural and urban, colored and

white, and extends to all occupations and branches of industry.

Three of the diseases of childhood, measles, scarlet fever and whooping cough, had encouragingly low death rates, while influenza and pneumonia reached unexpected low records. Never, except in the years immediately following the big influenza epidemics of 1918 and 1919, has there been as big a drop in the number of deaths from these much-dreaded plagues.

To counterbalance these gratifying returns, the toll of cancer was higher than ever before and that of diabetes remained the same as last year in spite of the increasing use of insulin. This, however, is no ground for drawing the conclusion that insulin is ineffective. Statisticians declare that the average age of diabetics at death has increased, and that without insulin the diabetes death rate would undoubtedly run even higher than it now is.

The automobile continued its guilty rôle in 1927 as principal cause of fatal accidents. Almost as many wage-earners' children lost their lives in 1927, it was pointed out, from automobile accidents as from measles, scarlet fever and whooping cough combined, while the number of motor car fatalities as a whole was double that of ten years ago.

RELIGION AND ZOOLOGY

FUNDAMENTAL religion is supported by the scientific truths of zoology, although that science often finds itself unable to substantiate the claims made by the various sects and churches, especially when these are made by men who may be authorities in theology, but have no scientific background.

This was the position taken by Dr. Charles Wardell Stiles, secretary of the International Commission on Zoological Nomenclature, in an address before one of the leading church audiences of Washington.

Fundamental religion might be summed up in one word, "obligation," as exemplified in the golden rule and the famous definition of St. James: "To visit the fatherless and widows in their affliction, and to keep himself unspotted from the world." Special assertions about the existence and nature of God at once carry one beyond the constitution of religion and into a discussion of its by-laws, he said, and since these differ with different religions and sects, science is unable to agree with all of them, and may not be able to agree on certain points with any.

Obligation, the foundation of religion, might further be expressed in the phrase of the school-yard, "Play the game," and it is in inculcating the necessity of playing the game with one's fellowman, fairly and squarely, that zoological facts most strongly support religious teaching. Our hospitals and prisons are crowded with men who have failed to "play the game" according to the rules of nature no less than according to the rules of religion; they preach a more powerful sermon than can be heard from any pulpit on the effects of the sins of the fathers on the third and fourth generations.

It is only when the theologian fails to stick to his last, and wanders over into a field where the zoologist knows more than he, that apparent conflict arises between science and one of the religions, Dr. Stiles declared. The current controversy over evolution offers a good example of this difficulty. And really, the speaker continued, the anti-evolutionists among the churches are more radical evolutionists than the zoologists themselves, for they acknowledge the development of all the religions of the world to-day from the one religion that must have prevailed in the Garden of Eden. And on the physical side, if all the races of the world have arisen among the descendants of Noah since the flood, this is carrying on human evolution at a far faster rate than any zoologist would dare to claim before a scientific audience.

ITEMS

THE "ether drift" which, if it exists, would force the abandonment or radical modification of the Einstein theory, is declared to be non-existent by two Swiss scientists, Dr. A. Piccard and Dr. E. Stahel, of the University of Freiburg, as the result of experiments performed at the summit of the Rigi, a lofty peak in the Alps. The first effort to show a drifting motion, relative to the earth, of the hypothetical ether in which light waves travel was made about a half-century ago, by two American physicists, Dr. A. A. Michelson and Dr. S. G. Morley. Their results showed a small positive effect, but were not regarded as conclusive. During the past few years Dr. Dayton C. Miller, of the Case School of Applied Science, Cleveland, has been repeating the experiment with improved apparatus at the summit of Mt. Wilson, Calif., which has about the same altitude as the Rigi. His results have been definite and positive, but have nevertheless been the subject of much controversy.

BLACKBOARDS of translucent ground glass lighted from behind are proposed as a substitute for the opaque black surface familiar to every school child. Professor W. Weniger, of Oregon Agricultural College, has demonstrated this new blackboard and is using it in teaching his physics classes. The old type of blackboard is difficult to illuminate so that all the room can see, Professor Weniger found, while the ground glass lighted from the rear electrically allows everything chalked upon it to be seen from all parts of the room even when a combination of daylight and artificial illumination is being used. Erasing on the new "blackboard" is easy. It can also be used as a stereopticon screen and chalk talks can be interspersed with lantern slides without changing the lighting of the room.

THAT watercress, the familiar garnish for meat and salad, is a remarkably rich source of the vitamin necessary for growth and of the scurvy-preventing vitamin C, has been found by Dr. Katherine H. Coward and P. Eggleton, of the University of London. It boasts of small quantities of vitamin D as well in its small green leaves. The green shows considerable seasonal variation, however, in its growth-promoting properties, being more effective with laboratory animals in this respect in spring and summer than in winter.